



NEWFOUNDLAND AND LABRADOR

DEPARTMENT OF ENVIRONMENT

WATER RESOURCES
REPORT 2-7
GROUNDWATER SERIES

**HYDROGEOLOGY
OF
THE BURIN PENINSULA AREA**

by

GOLDER ASSOCIATES
ST. JOHN'S, NEWFOUNDLAND
1985

DEPARTMENT OF ENVIRONMENT
WATER RESOURCES DIVISION
ST. JOHN'S, NEWFOUNDLAND

ABSTRACT

Within the Burin Peninsula area, groundwater is obtained for domestic purposes from wells developed in both the overburden deposits and the underlying bedrock.

A total of 128 records of drilled wells are available within the study area from the Newfoundland Department of Environment. In addition to drilled wells, there are many shallow dug wells within the area for which no records exist.

The Burin Peninsula area is predominantly underlain by folded and metamorphosed volcanic and sedimentary rocks of Hadrynian to Cambrian age. These strata have been intruded by extensive granitic batholiths of Hadrynian to Devonian age. Both major and minor fault structures occur within the bedrock. These features tend to occur sub-parallel to the regional northeast-southwest structural trends within the area.

Groundwater within the strata underlying the study area is associated with secondary fracture related permeability. The well yields from the rock strata are generally low to moderate, in the order of 10 to 50 L/min. However, moderate to high yields are locally obtainable from Devonian sedimentary strata located along the northwest shore of Fortune Bay in the vicinity of English Harbour West.

The St. Lawrence Granite around the community of St. Lawrence in the southern half of the Burin Peninsula is well known for high groundwater yields due to its extensively fractured and fissured nature. The municipal well for the community of St. Lawrence which was developed within this granite supplied water at a rate of 568 L/min. The nearby Director Mine continuously pumped 9464 L/min from its underground flouspar mine within this granite.

The quality of groundwater obtained within the study area is good, consisting of soft calcium, magnesium and bicarbonate water. However, groundwater obtained from the St. Lawrence Granite tends to have flouride concentrations in excess of recommended or permissible levels. The groundwater from the granite also tends to have elevated radon gas concentrations.

TABLE OF CONTENTS

	<u>Page No.</u>
ABSTRACT	i
1.0 INTRODUCTION	1
1.1 Scope of Study	1
1.2 Location	1
1.3 Acknowledgements	2
1.4 Previous Work	3
2.0 POPULATION AND ECONOMY	4
3.0 PHYSIOGRAPHY	6
4.0 CLIMATE	8
5.0 GEOLOGY	10
5.1 Surficial Geology	10
5.1.1 Exposed Bedrock	10
5.1.2 Glacial Till Deposits	11
5.1.3 Outwash Sand and Gravel Deposits	12
5.1.4 Peat Deposits	12
5.2 Bedrock Geology	12
5.2.1 Stratigraphy	14
5.2.1.1 Hadrynian	14
5.2.1.2 Cambrian	16
5.2.1.3 Ordovician	16
5.2.1.4 Devonian	17
5.2.1.5 Carboniferous	17
5.2.2 Structure	18
6.0 HYDROGEOLOGY	21
6.1 Hydrostratigraphic Units	21
6.1.1 Surficial Hydrostratigraphic Units	24
6.1.1.1 Unit A - Till Deposits	24
6.1.1.2 Unit B - Sand & Gravel Deposits	25
6.1.2 Bedrock Hydrostratigraphic Units	25
6.1.2.1 Unit 1 - Hadrynian Volcanic Rocks	29
6.1.2.2 Unit 2 - Hadrynian and Cambrian Sedimentary Rocks	29

TABLE OF CONTENTS (cont'd)

	<u>Page No.</u>
6.1.2.3 Unit 3 - Ordovician Sedimentary Rocks	30
6.1.2.4 Unit 4 - Devonian and Carboniferous Sedimentary Rocks	30
6.1.2.5 Unit 5 - Hadrynian and Devonian Granitic and Gneissic Rocks	31
6.1.2.6 Unit 6 - Carboniferous St. Lawrence Granite and Grand Beach Porphyry Rocks	32
6.2 Groundwater Flow Systems	33
6.2.1 Shallow Flow Systems	34
6.2.2 Deep Flow Systems	35
6.3 Groundwater Recharge	36
6.4 Groundwater Quality	40
6.4.1 Overburden Groundwater Quality	40
6.4.2 Bedrock Groundwater Quality	42
6.5 Groundwater Contamination	46
6.6 Surface Water Quality	47
7.0 CONCLUSIONS	52

In order
following Page 54

LIST OF REFERENCES

LIST OF APPENDICES

- APPENDIX I Census Data, Burin Peninsula Study Area
Newfoundland
- APPENDIX II Water Well Records, Burin Peninsula Study Area,
Newfoundland

LIST OF MAPS

- Map No. 1 Surficial Geology and Hydrostratigraphic Units,
Burin Peninsula Area, Newfoundland
- Map No. 2 Bedrock Geology, Burin Peninsula Area,
Newfoundland
- Map No. 3 Bedrock Hydrostratigraphic Units, Burin
Peninsula Area, Newfoundland

TABLE OF CONTENTS (continued)LIST OF TABLES

	<u>Page No.</u>
1. Annual Precipitation and Average Daily Temperature, 1951 to 1980, Burin Peninsula Area, Newfoundland	9
2. Communities Served by Municipal Wells, Burin Peninsula Area, Newfoundland	23
3. Surficial Deposit Hydrostratigraphic Units, Burin Peninsula Area, Newfoundland	26
4. Bedrock Hydrostratigraphic Units, Burin Peninsula Area, Newfoundland	27
5. Water Balance 1982 to 1983, Garnish River Drainage Basin, Burin Peninsula Area, Newfoundland	38
6. Water Balance 1982 to 1983, Salmonier River Drainage Basin, Burin Peninsula Area, Newfoundland	39
7. Groundwater Chemistry of Overburden Wells, Burin Peninsula Area, Newfoundland	41
8. Groundwater Chemistry of Bedrock Wells, Burin Peninsula Area, Newfoundland	43 & 44
9. Summary of Surface Water Chemistry, Sept. 4, 1971, to Feb. 3, 1979, Garnish River Near Garnish, Burin Peninsula Area, Newfoundland.	48
10. Surface Water Chemistry, Burin Peninsula Area, Newfoundland	50

TABLE OF CONTENTS (continued)

LIST OF FIGURES

	<u>Following Page No.</u>
1. Study Area Location Plan, Burin Peninsula Area, Newfoundland	1
2. Location of Weather Stations, Burin Peninsula Area, Newfoundland	8
3. Average Daily Temperatures For The Period 1951 to 1980 From Environment Canada Weather Stations, Burin Peninsula Area, Newfoundland	9
4. Average monthly precipitation For The Period 1951 to 1980 From Environment Canada Weather Stations, Burin Peninsula Area, Newfoundland	9
5. Well Yield and Depth Relationships, Hydrostrati- graphic Units, 1, 2 and 3, Burin Peninsula Area, Newfoundland	27
6. Well Yield and Depth Relationships, Hydrostrati- graphic Units 4, 5, and 6, Burin Peninsula Area, Newfoundland	27
7. Watershed Boundaries for Garnish and Salmonier River Basins, Burin Peninsula Area, Newfoundland	36
8. Stream Flow Hydrographs for Garnish and Salmonier River Basins, Burin Peninsula Area, Newfoundland	36
9. Groundwater and Surface Water Chemistry Data Availability, Burin Peninsula Area, Newfoundland	40

1.0 INTRODUCTION

1.1 Scope of Study

The hydrogeological investigation of the Burin Peninsula area of southeastern Newfoundland was undertaken by Golder Associates for the Water Resources Division, Department of Environment, Province of Newfoundland. The study, in compliance with the guidelines provided by the Department of Environment, provides a hydrogeological evaluation of the bedrock and surficial deposits from existing published and unpublished information. Potential groundwater yields from the various geological subdivisions within the study area are evaluated. In addition, the investigation provides data on groundwater quality within the area and an overview of the potential for groundwater contamination.

This is the seventh report of a series of groundwater investigations being carried out by the Department of Environment as an inventory of the currently available hydrogeological information to enhance the understanding of the groundwater resources of Newfoundland.

1.2 Location

The Burin Peninsula study area is located in southeastern Newfoundland as outlined in Figure 1. The area is bounded in the east by 54° 30' west longitude and the west boundary is 56° 00' west longitude. The northern boundary is 48° 00' north latitude. The area encompasses the Burin Peninsula east of Paradise Sound, the Fortune Bay area including Brunette Island, Hermitage Bay and Baie D'Espoir.

STUDY AREA LOCATION PLAN
BURIN PENINSULA AREA, NEWFOUNDLAND

FIGURE 1



1.3 Acknowledgements

This report was prepared by Mr. R.D. Blair with the assistance of Mr. T.A. McIelwain and Ms. L.M. Calder. These individuals are hydrogeologists with Golder Associates.

A large portion of the information provided in this report was obtained in the form of unpublished files and individual experience obtained directly from persons in the public service and private industry sectors. Accordingly, appreciation is extended to the following Agencies and individuals for their assistance.

Department of Environment, Water Resources Branch
Dr. W. Ullah, P. Eng., Director of Water Resources
Division, Mr. J. Robinson, Groundwater Resources
Manager, Mr. K. Domine, P. Eng., Director of
Civil/Sanitary Environmental Engineering Division.

Department of Mines and Energy
Mr. N. Mercer, Mineral Exploration Consultant,
Mr. D.G. Vanderveer, Senior Geologist, Environmental
Geology Section, Mr. S.J. O'Brien, Geologist III, Mined
Development Division.

Department of Labour and Manpower
Mr. R.G. March, P. Eng., Director, Mines Inspection
Branch.

Department of Health
Mr. N. Goss, Manager of Environmental Health Inspection
and Services Division, Eastern Health Unit, Holyrood.

Newfoundland Statistics Agency

Mr. H. Ridler, Statistician, Government of Newfoundland and Labrador.

Environment Canada

Mr. F.S. Porter, Scientific Services Meteorologist

Mr. D. Snow, Area Head, Inland Waters Directorate.

C-CORE, Memorial University

Ms. M. Segall, B.Sc., Research Geologist.

1.4 Previous Work

Previous hydrogeological investigations within the Burin Peninsula area are limited. However, a general review has been included in sections of a major study carried out by Shawinigan Engineering Company Limited and James F. MacLaren Ltd. entitled "Water Resources Study of the Province of Newfoundland and Labrador for the Atlantic Development Board. (Shawinigan Engineering et al 1968). This report provides a general overview of the groundwater resource in Newfoundland (Volume 2B, Part VIII) and a more specific study of the Burin Peninsula. (Vol. 7, Part III Section 15-18). A major source of hydrogeological data for the study area is contained in a report entitled "Water Well Data for Newfoundland, 1950-1977" (Consumer Affairs and Environment, 1979). This incorporates a summary of drilled water well data provided by commercial well drillers. Requirements concerning the submittal of such data during the 1950 to 1977 period were not as stringent as at present and subsequently the available information is not complete. More recent well data in the form of open file well records were obtained from the Department of Environment.

2.0 POPULATION AND ECONOMY

The Burin Peninsula study area has a population of approximately 39,500 (1981 Census data), located in some 60 incorporated and unincorporated communities. The area includes parts of the provincial electoral districts of Burgeo-Bay D'Espoir, Grand Bank, Fortune-Hermitage and Burin-Placentia West. Census data from 1951, 1956, 1961, 1966, 1971, 1976 and 1981 (Newfoundland Statistics Agency, 1980 and 1981) is included in Appendix I for those communities within the portions of the four provincial electoral districts that fall within the study area. The largest communities in the study area are Marystown, (population 6,299), Grand Bank, (population 3,901), Burin, (population 2,904), Fortune, (population 2,473), St. Lawrence, (population 2,012) and Harbour Breton, (population 2,464).

Most electoral districts exhibit some growth in population over the period 1951 to 1981, in the range of 0.4 to 42.3 percent. However, modest to high declines in population of from 0.7 to 34.0 percent occurred over the 30 year period in 6 of the incorporated communities. Most of the unincorporated communities have also experienced population decreases, as people have moved to larger centres. There has been an overall 30 year growth increase for the study area of approximately 8.7 percent, while the 10 year growth rate between 1971 and 1981 was slightly greater, approximately 10 percent.

The major economic activity within the Burin Peninsula area is centered around inshore and offshore fishing and fluorspar mining at St. Lawrence. The fluorspar mining activity ceased in 1977, however there is currently (1985) renewed interest to reactivate one of the old mines. A modest

ship building and servicing industry for the fishing and offshore oil industry has been developed at Marystown. Fish processing plants are located in Marystown, Burin, Fortune, Grand Bank Harbour, Breton and Gaultois. Unlike fishing, the area is not well suited to forestry or agricultural activities, although small scale farming is carried on in the southwest of the study area. The Town of Fortune serves as the Newfoundland terminus of the St. Pierre and Miquelon ferry service, and thus supports a small tourist industry.

3.0 PHYSIOGRAPHY

The Burin Peninsula study area which includes the Burin Peninsula and the area north of Fortune Bay and Bay D'Espoir forms part of the 'Atlantic Upland' physiographic subdivision of Twenhofel and MacClintock (1940). The area is characteristically rugged, with bedrock controlled ridges and north-east-southwest trending coastal bays and inlets.

The Burin Peninsula itself forms a promontory that extends some 140 km southwest from the main body of the Island of Newfoundland separating Placentia Bay to the east from Fortune Bay to the west. The width of the peninsula varies from 15 to 25 km. The peninsula has a rolling, rugged topography controlled by northeast-southwest trending bedrock ridges that vary in elevation from approximately 50 to 375 m above mean sea level. The Peninsula is separated into a northern and a southern highland by a lowland area that extends from the Burin-Marystown area on the east coast to the Frenchmans Cove-Garnish area on the west coast. This area, including Freshwater Pond and Southwest Arm has elevations mostly below 75 m. The major height of land occurs within the northern half of the peninsula bordering Fortune Bay from the Garnish Blue Hills to Terrenceville where several bedrock ridges attain elevations of 300 to 375 m.

The Burin Peninsula is drained by several small rivers the largest being the Garnish River which has a drainage basin of 205 sq. km. There are numerous small ponds throughout the peninsula of which the largest are Freshwater Pond and Garnish Pond in the Marystown area.

The area to the north of Fortune Bay including Bay D'Espoir is characterized by a rugged coastline with numerous northeast trending bays and inlets. The coastline is marked by rock cliffs that rise 50 to 150 m above sea level. The highest elevations are encountered inland from Hermitage Bay where bedrock ridges attain elevations of 300 to 375 m. The inland areas to the north of Fortune Bay and Terrenceville have a comparatively subdued, rolling topography that varies in elevation from 150 to 280 m. These areas are drained by numerous small rivers but also contain the lower courses of large river basins including the Conne River (619 sq km.), Bay Du Nord River (1176 sq km.) and Long Harbour River (1010 sq km.)

The ground surface throughout the Burin Peninsula and Fortune Bay study area is predominantly barren, with exposed bedrock or thin surficial deposits and large areas of bog. The vegetative cover mainly consists of low grasses, sedges and lichen. Forested areas of spruce and alder are restricted to the more sheltered valleys within the region and portions of the lowland area between Marystown and Frenchman's Cove.

4.0 CLIMATE

The climatic conditions within, and immediately adjacent to the study area have been monitored at 4 weather stations for portions of the period from 1951 to 1980 (Environment Canada, 1981). These stations include Argentia, Burin, Grand Bank and St. Lawrence and their locations are shown in Figure 2. The total annual precipitation and annual daily average temperature for these stations are listed in Table 1. The average monthly temperature and precipitation for the stations are presented in histogram form in Figures 3 and 4.

The Burin Peninsula area has a temperate, maritime climate influenced by the Gulf of St. Lawrence. The annual average daily temperature within the study area varies within a range from 4.5°C at St. Lawrence to 5.5°C at Grand Bank. The annual average daily temperature at Argentia Station, which lies outside the study area, is 5.7°C. (See Table 1). The mean monthly temperature is below freezing from December through March as shown in Figure 3. The warmest periods occur during July and August when average daily temperatures range from 12 to 16°C.

The average annual precipitation within the study area varies from 1099.3 to 1450.2 mm as measured at the Burin, Grand Bank, and St. Lawrence weather stations. The mean annual precipitation at the Argentia station is 446.6 mm (See Table 1). The greatest amount of precipitation occurs on the southern shore. The lowest periods of monthly precipitation occur during the spring and early summer (See Figure 4).

LOCATION OF WEATHER STATIONS BURIN PENINSULA AREA, NEWFOUNDLAND

FIGURE 2

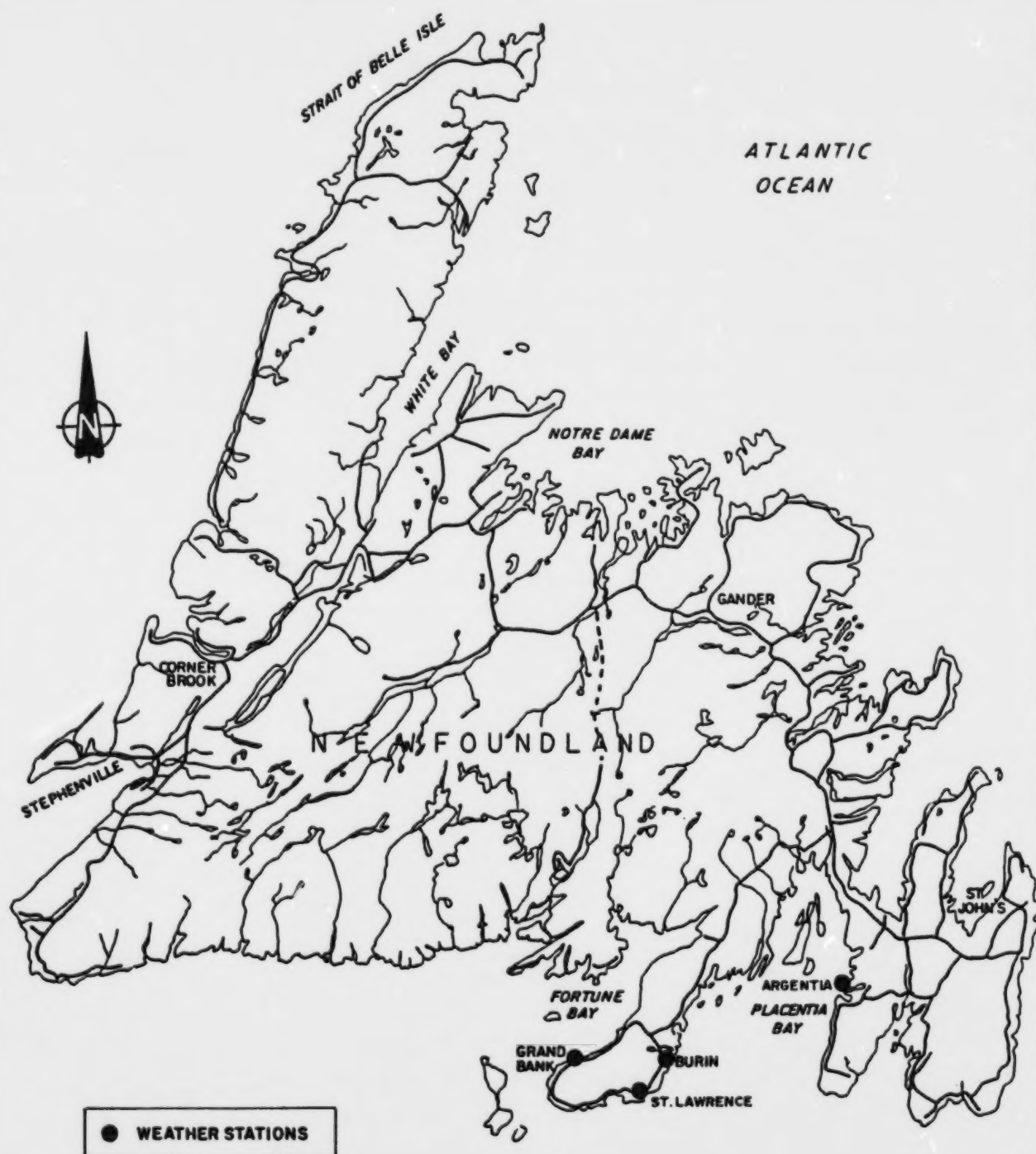


TABLE 1

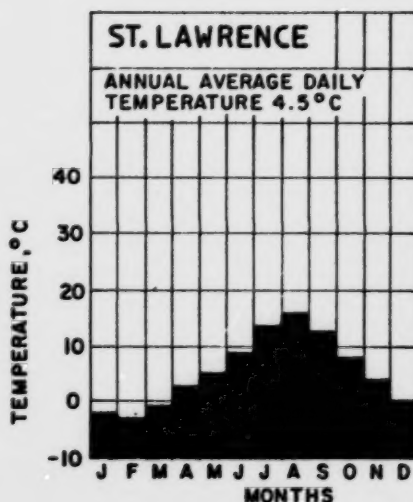
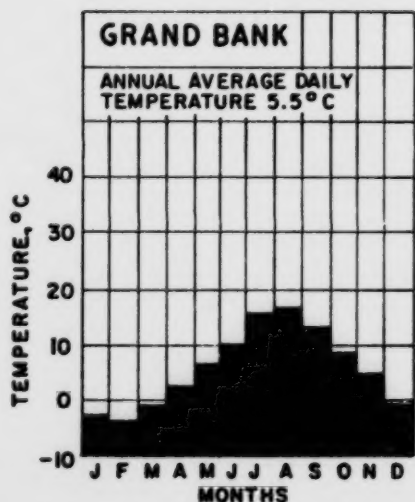
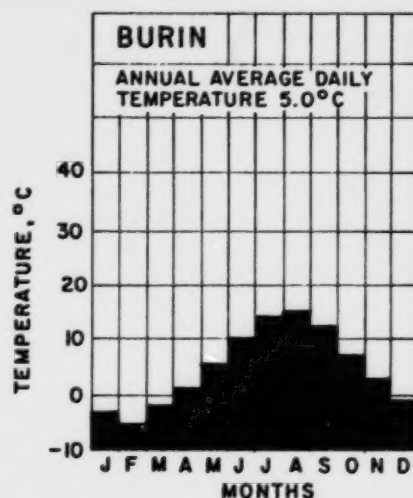
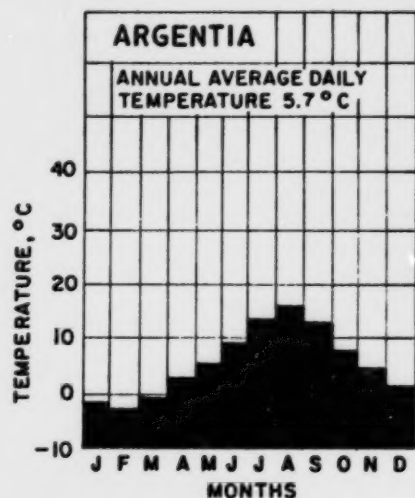
ANNUAL PRECIPITATION AND AVERAGE
DAILY TEMPERATURE, 1951 TO 1980
BURIN PENINSULA AREA, NEWFOUNDLAND

<u>Station</u>	<u>Annual Precipitation (mm)</u>	<u>Average Daily Temperature °C</u>
Argentia	446.6	5.7
Burin	1219.0	5.0
Grand Bank	1099.3	5.5
St. Lawrence	1450.2	4.5

Reference: Data from Environment Canada, 1981, Canadian Climatic Normals, 1951-1980. Temperature and Precipitation, Atlantic Provinces, Atmospheric Environment Service, Ottawa, Canada, 1981.

**AVERAGE DAILY TEMPERATURE PER MONTH FOR THE PERIOD
1951 TO 1980 FROM ENVIRONMENT CANADA WEATHER STATIONS
BURIN PENINSULA AREA, NEWFOUNDLAND**

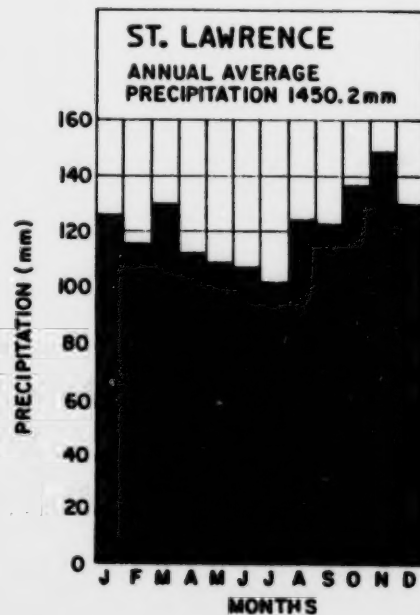
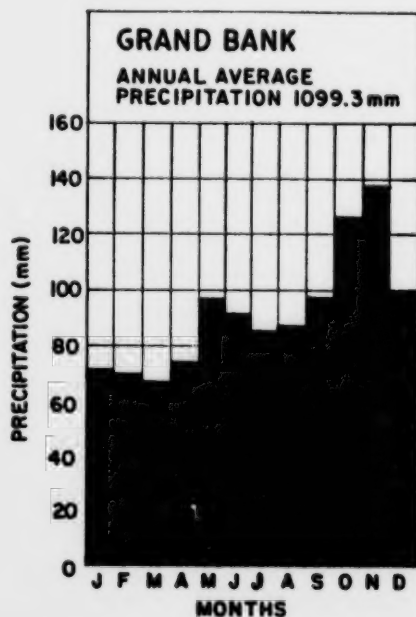
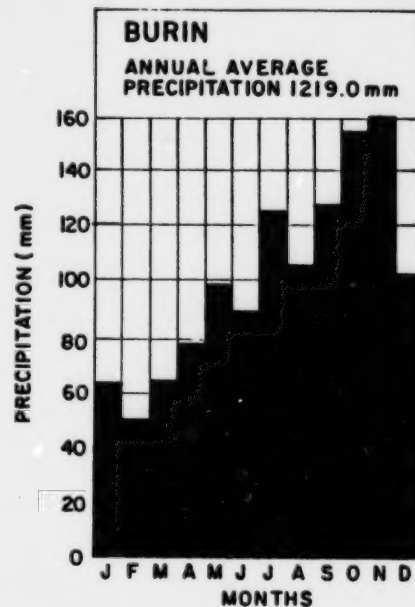
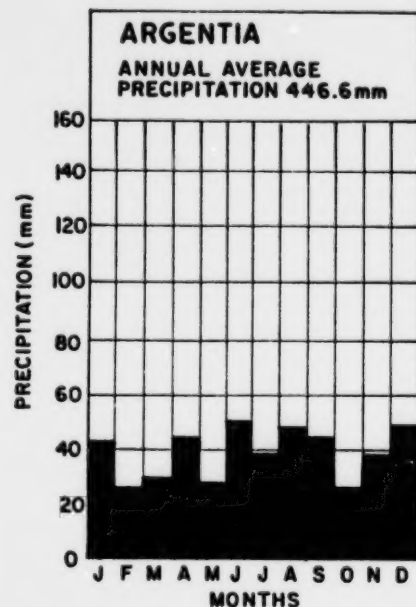
FIGURE 3



REFERENCE:
DATA FROM ENVIRONMENT CANADA, 1981.

**AVERAGE MONTHLY PRECIPITATION FOR THE PERIOD 1951 TO 1980 FROM ENVIRONMENT CANADA WEATHER STATIONS
BURIN PENINSULA AREA, NEWFOUNDLAND**

FIGURE 4



REFERENCE:
DATA FROM ENVIRONMENT CANADA, 1981

5.0 GEOLOGY

5.1 Surficial Geology

The surficial geology of the Burin Peninsula study area has been compiled at a scale of 1:250,000 on Map 1 accompanying this report. The map represents a summary of the surficial mapping that has been carried out within the area by the Newfoundland Department of Mines and Energy. This mapping was carried out largely by air-photo interpretation at a scale of 1:50,000 with limited ground traversing and is ongoing within the area. To date it covers approximately two-thirds of the study area. Mapping within the Point Enragee, Paradise Sound, Gisborne Lake and southern Bay D'Espoir areas has not been completed.

For the purpose of this study, the surficial geological units shown on the existing maps have been combined into four groups. These groups are: areas of exposed bedrock, areas of glacial till, areas of sand and gravel and areas of peat deposits.

5.1.1 Exposed Bedrock

Areas of exposed bedrock form extensive rock plains, knobs and ridges throughout much of the study area, specifically within the rugged terrain to the north of Fortune Bay. Exposed bedrock also comprises much of the northern half of the Burin Peninsula. The rock may be partially or fully concealed in places by tundra vegetation and sparse forest. A thin soil veneer generally comprised of till occasionally occurs adjacent to rock outcrops.

5.1.2 Glacial Till Deposits

Glacial till deposits occur throughout the study area as both thin till veneers and as more extensive moraine deposits. Till veneer in the order of 1 m thick or less occurs throughout much of the study area. More extensive development of till moraine occurs in the areas of less rugged topography on the southern half of the Burin Peninsula, the area north of the Long Harbour inlet, and the area north of Bay D'Espoir. Based on water well records the tills within these areas vary in thickness from 1 to 10 m. Elsewhere the thicker till moraine deposits are largely restricted to valleys adjacent to areas of bedrock ridges.

The composition of the tills closely reflects the lithology of the underlying bedrock. The tills within areas underlain by granitic bedrock inland to the north of Fortune Bay and locally within the Burin Peninsula tend to be comprised of silty sand to sandy silt. The areas of volcanic terrain underlying much of the Burin Peninsula tend to have a silty sand till composition. The tills associated with areas underlain by softer shaly rocks such as in the Bay D'Espoir area tend to have a more clayey composition.

Water well records indicate that anomalously thick overburden (from 30 to 50 m thick) occurs locally within the communities of Lawn, Marystown and Salt Pond (see Appendix I). The thick overburden encountered is considered to be glacial till or a similar fine grained material as these materials did not yield sufficient groundwater for completing a well.

5.1.3 Outwash Sand and Gravel Deposits

Sand and gravel deposits of kame, outwash and fluvial origin and unsubdivided lacustrine and marine terrace and beach deposits occur sparingly throughout the study area. The deposits tend to occur most extensively within stream valleys or as local raised beaches and marine terraces along the coastline. The deposits appear to occur most extensively within the southern half of the Burin Peninsula notably within valleys between the communities of Lamaline and Grand Bank and between Marystown and Frenchman's Cove (see Map 1). Outwash sands and well sorted gravel occur extensively in the vicinity of Winterland and Freshwater Pond (Vanderveer, 1977).

5.1.4 Peat Deposits

Peat deposits occur extensively throughout the study area, covering much of the barren lands. The peat has accumulated in the form of high moor bogs, string bogs and marsh areas. The peat can attain thicknesses of several metres and has developed upon either till, fluvial deposits or bedrock.

In some locations near Winterland, bogs have locally undergone limited development including experimental agriculture and mining for fuel and peat moss (Lear, 1960). All efforts have included drainage.

5.2 Bedrock Geology

The interpretation of the bedrock geology within the Burin Peninsula study area represented in Map 2 of this report was developed from the preliminary geological

compilation map of Belleoram and St. Lawrence, Map 81-116, scale 1:250,000, Department of Mines and Energy, Government of Newfoundland and Labrador. For the purposes of this study rock strata of similar lithology, structure and age have been grouped together.

In addition to the regional compilation map a review was carried out of several detailed geological reports that have been recently prepared for the Burin Peninsula area by the Mineral Development Division, Department of Mines and Energy, Government of Newfoundland and Labrador. These reports are listed chronologically as follows:

- 1976 - Geology of the St. Alban's Map Area, Newfoundland (1M/13) by S.D. Colman-Sadd, Report 76-4, St. John's, Newfoundland, 1976.
- 1977 - The Geology of the Grand Bank (1M/4) and Lamaline (1L/13) Map Areas, Burin Peninsula Newfoundland, by S.J. O'Brien, P.G. Strong and J.L. Brans, Report 77-7, St. John's, Newfoundland, 1977.
- 1978 - Geology of the Marystown (1M/3) and St. Lawrence (2L/14) Map Areas, Newfoundland by D.F. Strong, S.J. O'Brien, S.W. Taylor. P.G. Strong, D.H. Wilton, Report 77-8, St. John's, Newfoundland, 1978.
- 1983 - Geology of the Baine Harbour (1M/7) and Point Enragee (1M/6) Map Areas, Southeastern Newfoundland by, S.J. O'Brien, S.W. Taylor, Report 83-5, St. John's, Newfoundland, 1983.

- 1983 - Geology, Geochemistry and Mineral Potential of the Ackley Granite and Parts of the Northwest Brook and Eastern Meelpaeg Complexes, Southeast Newfoundland (Parts of Map Areas 1M/10, 11, 14, 15, 16, 2D/1, 2, 3, and 7) by W.L. Dickson, Report 83-6, St. John's, Newfoundland, 1983.
- 1984 - Geology of the Terrenceville (1M/10) and Gisborne Lake (1M/15) Map Areas, Southeast Newfoundland by S.J. O'Brien, G.A.G. Nunn, W.L. Dickson and J. Tuach, Report 84-4, St. John's, Newfoundland, 1984.

5.2.1 Stratigraphy

5.2.1.1 Hadrynian

The Burin Peninsula, north shore of Fortune Bay and the Connaigre-Hermitage Bay areas are largely underlain by rocks of Hadrynian age (Late Precambrian). These include volcanic and sedimentary strata of the Burin, Love Cove, Marystown, Long Harbour and Connaigre Bay Groups. The Marystown and Love Cove Groups are considered to be stratigraphically equivalent (O'Brian, 1983).

Volcanic strata predominate. These rocks are mainly comprised of subaerial, felsic porphyritic flows and pyroclastics. The felsic volcanics form massive highly indurated outcrops characteristic of the upland terrain within the area. Mafic volcanic and scericitic and chloritic schistose rocks occur but are less prevalent. However, the Burin Group located along the southeast shore of the Burin Peninsula is predominantly tholeiitic basalt. Volcanoclastic sediments also occur to a minor degree interbedded within the volcanic strata.

The upper half of the Hadrynian sequence is comprised of sedimentary rocks that both conformably, and locally disconformably, overlie the volcanic rocks although they are much less extensive than the volcanics. The sediments are characteristically, volcanically derived, grey, green or purple sandstones, siltstones, argillites and conglomerates. The sediments form a belt within the Love Cove Group that extends from the Point Enragee area northeastward past Terrenceville and these strata also occur to a more limited extent within the Marystown Group. Similar strata occur within the Long Harbour Group east of the Long Harbour inlet. Hadrynian sedimentary strata also occur east of the Paradise Sound Fault and on Jude Island in Placentia Bay.

The Connaigre Bay Group is a complexed sequence of felsic volcanic and overlying volcanoclastic sediment similar to the Long Harbour Group. The western half of the Group is predominantly massive mafic volcanic. The Group is extensively disrupted by faulting and granitic intrusions.

Hadrynian age granite and granodiorite plutons intrude and locally metamorphosed the volcanic and sedimentary strata of the Love Cove Group in the northern half of the Burin Peninsula. The plutons are northeast-southwest elongated features with foliated margins and massive interiors. The plutons are resistant features that form upland areas. Hadrynian age granite, granodiorite and diorite plutons also intrude the rocks of the Connaigre Bay Group in the north-western Fortune Bay area. A large gabbro sill approximately 25 km in length occurs within the Burin Group along the southeast shore of the Burin Peninsula.

The Little Passage Gneisses located in the northwest corner of the study area (See Map 2) were initially considered to be of Hadrynian age or earlier (Colman-Sadd, 1976) but are now considered to be high grade metamorphic equivalents of the Gander Zone Ordovician strata (O'Brian, Personal Communication, 1985). The gneisses form a northeast trending belt comprised of banded micaceous gneiss of sedimentary origin and interlayered granitic and amphibolitic gneiss. The gneisses are extensively deformed and granitized and form resistant upland terrain.

5.2.1.2 Cambrian

Cambrian sedimentary strata occur along the southern half of the Burin Peninsula and the northwest shore of Fortune Bay. The strata are predominantly comprised of fine grained sandstone, quartzite, siltstone, shale, slate and minor limestone. The Cambrian rocks both conformably and disconformably overlie the Hadrynian sequences, but in most instances they are in fault contact. The Cambrian strata exhibit the same folding and foliation as the underlying Hadrynian rocks.

5.2.1.3 Ordovician

Ordovician sedimentary rocks of the Baie D'Espoir Group underlie the Baie D'Espoir area in the northwest corner of the study area (See Map 2). The strata are comprised of fine grained pelitic siltstone, slate and minor sandstone. The metamorphic grade increases southeastward within the Group where pelitic schist and phyllite border the Little Passage Gneisses.

5.2.1.4 Devonian

Devonian sedimentary rocks occur along the northwest shore of Fortune Bay in the English Harbour West, Great Bay de l'Eau and Pools Cove areas. These rocks include thickly bedded red to purple conglomerate, arkosic to micaceous sandstone and minor shale and limestone. They unconformably overlie Hadrynian and Cambrian strata. Devonian to Carboniferous sedimentary rocks also occur at Terrenceville.

Granitic plutons of Devonian age, notably the Ackley Granite, underlie much of the northern half of the study area (See Map 2). The granites are massive textured, fine to coarse grained bodies with intrusive contacts and associated metamorphism of the Devonian sedimentary rocks and the other older strata within the area.

5.2.1.5 Carboniferous

The St. Lawrence Granite is the major Carboniferous age rock sequence within the area. This granite comprises a north south trending pluton on the southern end of the Burin Peninsula that extends from St. Lawrence to Winterland. The pluton is a high level feature with roof pendants of comagmatic porphyritic rhyolite and older Marystown Group volcanics. The emplacement of the pluton is considered to have been controlled by a north-south fault system (Strong et al, 1978). It is extensively fractured and open vugs and fissures are common.

The St. Lawrence Granite hosts the economically important vein type flourspar deposits that have been extensively mined in the St. Lawrence area. Minor occurrences of base metal sulphides are also associated with the granite.

The Grand Beach Complex, located on the southwestern shore of the Burin Peninsula is comprised of massive porphyritic rhyolite that includes lesser amounts of sedimentary strata, felsic pyroclastic and mafic volcanics. The Grand Beach Complex may be genetically related to the St. Lawrence Granite.

5.2.2 Structure

The dominant structural trends within the study area are orientated northeast southwest, reflecting the regional structure of the island of Newfoundland. The Hadrynian strata underlying the study area lie within the structural domain of the Avalon Zone whereas the Ordovician strata located northwest of the Hermitage Bay Fault lie within the Gander Zone of the Central Mobil Belt (Williams, 1978).

The volcanic and sedimentary strata of the Burin Peninsula including the Marystown, Love Cove Groups and the Burin Groups and the overlying Cambrian sediments comprise the northeast southwest trending, Burin Anticlinorium (Williams, 1978). The rock strata are variously folded into steeply dipping isoclinal structures and more open folds. The rocks, including the Hadrynian granitic plutons have undergone regional metamorphism to greenschist facies during which a northeast southwest trending foliation was developed. The foliation varies from a fracture cleavage to a schistosity within fine grained rocks and it is less evident in the massive felsic volcanics.

The Burin Anticlinorium is bounded by the Terrenceville Fault to the west and the Paradise Sound Fault to the east. These faults are major northeast trending features. The structural complexity of the Love Cove Group, noted by steeply dipping folds and extensive faulting, increases eastward toward the Paradise Sound Fault. The sedimentary strata east of the fault are noticeably less deformed.

To the west of the Terrenceville fault, the Long Harbour Group volcanic and sedimentary strata are regionally metamorphosed to greenschist facies and tend to form broad folds about northeasterly trending axes. The Long Harbour Group is less deformed than the Love Cove Group to the east. The Connaigre Bay Group is extensively deformed and dissected by faulting and numerous granitic intrusions. The Group is bounded by the Hermitage Bay Fault to the north west.

The regional metamorphism and deformation within the Hadrynian and Cambrian strata is attributed to the Silurian-Devonian aged Acadian Orogeny (O'Brian, 1983). The Ordovician strata of the Baie D'Espoir Group also underwent complex deformation during the Acadian Orogeny (Colman-Sadd, 1976). The pelitic sediments are regionally metamorphosed and steeply folded about northeast trending axes. A strong cleavage and schistosity is developed within the strata and it becomes more pronounced southeastward toward the thrust fault contact with the Little Passage Gneisses.

The Devonian sedimentary strata located along the northeast shore of Fortune Bay are much less deformed and metamorphosed than the underlying Hadrynian and Cambrian strata. The Devonian strata are gently folded and they have been intruded and hornfelsed by the Devonian age Harbour Breton and Belleoram Granites.

The granitic batholiths of Devonian age are post deformational features. Consequently they are massive with widely spaced jointing. In this respect they differ from the pre-deformational Hadrynian granites which are characteristically foliated along their margins. The Carboniferous St. Lawrence Granite also post dates the regional deformation within the area. However, due to its apparent high crustal level of intrusion and its fault related emplacement, associated with hydrothermal activity, this granite is extensively veined and fractured.

6.0 HYDROGEOLOGY

6.1 Hydrostratigraphic Units

The potential groundwater yield of the various geologic strata within the Burin Peninsula area was assessed by subdividing the surficial and bedrock lithologies within the study area into hydrostratigraphic units. The units are comprised of deposits with similar lithologic and structural character. These criteria are considered to reflect the potential water bearing nature of each unit. These lithologic groupings were then compared with the reported well yields and depths available from records of wells completed within the area underlain by each unit. The Surficial and Bedrock Hydrostratigraphic Units are shown in Maps 1 and 3 respectively.

The hydrogeological data provided from the available water well records within the Burin Peninsula area is limited. A total of 128 individual records of drilled wells were obtained for the study area from published (Consumer Affairs and Environment 1950 - 1977) and unpublished Department of Environment water well records. Of these records, 124 reported well depth while only 113 reported well yield. The majority of the wells have been drilled for domestic purposes, but records for 14 municipal wells, 4 industrial wells, 3 commercial wells, and 2 school wells are included. There are many additional drilled, dug, or bored wells for which no records exist.

The well yield characteristics were generally determined by either bailing or air blowing for a period of time considered sufficient by the driller to assess the well for the users' requirements. As such, the reported yields do not represent the precise well yield characteristics for the various strata encountered.

The available water well records for the Burin Peninsula study area are summarized in table form in Appendix II of this report. In addition to well depth and yield, the records provide some information concerning well casing depth and diameter, depths at which water was found, data on the quality and use of the water and a driller's description of the lithology of the overburden and bedrock types encountered. It should be noted, however, that individual well records are seldom complete. The published water well data does not include any records of overburden wells. However, the Shawinigan Engineering report (1968) indicates that shallow dug wells for which no records exist are used within the Burin Peninsula study area. The location of communities within the Burin Peninsula area, for which water well records exist, and the number of wells in each of the communities is shown on Map 3.

Additional information concerning groundwater supplies within the study area is provided in the report "National Inventory of Municipal Waterworks and Wastewater Systems in Canada" (Environment Canada, 1981). The report indicates that 5 communities (Baine Harbour, Little Bay, Red Harbour, St. Albans and Winterland) are supplied with water from a municipal well system. The size of each community and the estimated water usage are listed on Table 2. St. Albans

TABLE 2

COMMUNITIES SERVED BY MUNICIPAL WELLS
BURIN PENINSULA AREA, NEWFOUNDLAND

Community	Population	Pop. Served by Municipal Service	Average Water Consump- tion L/min	Designed Water Consump- tion L/min	Water Treat- ment
Baine Harbour	200	200	62.5	156.9	None
Little Bay	300	180	56.2	220.1	None
Red Harbour	250	250	78.5	156.9	
St. Albans	2500	1500	188.9	661.8	Chlorine Gas
Winterland	180	120	37.5	156.9	None

Reference: Environment Canada, 1981, National Inventory
of Municipal Waterworks and Wastewater Systems
in Canada, 1981.

(population 1500) municipal water consumption of 188.9 L/min. The remaining four communities (population 120 to 250) have a municipal water consumption of 35 to 80 L/min. The water quality of the municipal wells is checked annually or is requested by the Department of Public Health.

6.1.1 Surficial Hydrostratigraphic Units

As mentioned above, no published well records for overburden wells were available, however, based upon a general understanding of the hydrogeological character of the surficial deposits within the study area, the deposits have been subdivided into two broad hydrostratigraphic units. The one unit is comprised essentially of till deposits and the other is predominantly glacial outwash sand and gravel, as shown on Map 1.

6.1.1.1 Unit A - Till Deposits

The till deposits form a thin veneer over much of the study area and locally form more extensive moraine deposits in the southern half of the Burin Peninsula. They tend to have a fine sandy to silty composition and consequently a moderate to low permeability.

The till is utilized for shallow dugout domestic wells. The yields from these wells are generally low and generally depend on the well volume storage for adequate water supplies. Very little data on yields for dug wells in till is available for the study area, however data is available for dug wells in tills of a similar composition in the Notre Dam Bay area (Hydrology Consultants Limited, 1980). Based on this data the range of yield from wells within the till can be expected to

vary from 0 to 45 L/min. depending on the material encountered. The average yield is considered to be low, in the order of 9 L/min. or less (see Table 3).

6.1.1.2 Unit B - Sand and Gravel Deposits

Deposits of sand and gravel provide the greatest yield potential for surficial wells within the Burin Peninsula area. However, these deposits are not extensive within the study area where they are generally restricted to narrow stream valleys. Several isolated sand and gravel deposits occur within the southern half of the Burin Peninsula of which many are in close proximity to communities along the coast (see Map 1). As such, they represent potential sources for groundwater.

In the absence of existing well records for sand and gravel deposits within the study area, applicable data was obtained from hydrogeological studies of the Notre Dam Bay Area (Hydrology Consultants Limited, 1980), Humber Valley Area (Golder Associates Ltd., 1983) and Avalon Peninsula Area (Fracflow Consultants Inc., 1984). This data is summarized on Table 3. The data indicates that mean well yields of 25 to 100 L/min. are obtainable from sand and gravel deposits at mean depths of 13 to 21 m. Based on these yields, the sand and gravel deposits are considered to have a moderate to high well yield.

6.1.2 Bedrock Hydrostratigraphic Units

The bedrock underlying the study area has been subdivided into six hydrostratigraphic units based on rock type, structure and well yield. These units are summarized in Table 4 and shown in Map 3. The well yield and depth characteristics for these strata are also summarized in histogram form in Figures 5 and 6.

TABLE 3

SURFICIAL DEPOSIT HYDROSTRATIGRAPHIC UNITS
BURIN PENINSULA AREA, NEWFOUNDLAND

SURFICIAL HYDROSTRATIGRAPHIC UNIT	WELL YIELD, lpm (gpm)			WELL DEPTH, m (feet)			DATA SOURCE
	RANGE	MEAN	MEDIAN	RANGE	MEAN	MEDIAN	
UNIT A TILL LOW YIELD	0-45 (0-10)	9 (2)		5-46 (15-150)			1
UNIT B SAND AND GRAVEL MODERATE TO HIGH YIELD	55-270 (12-60)	25 (5.4)	23 (5)	8-27 (25-90)	14 (46)		1
	4-340 (1-70)	100 (22)	45 (10)	10-15 (32-50)	13.1 (43)	14 (45)	2
	5.7-182 (1.25-40.0)	40.6 (8.9)		8.5-65.5 (28-215)	20.9 (68.7)		3

SOURCES OF DATA:

1. HYDROGEOLOGICAL STUDY NOTRE DAME BAY AREA, NFLD.
WATER RESOURCES REPORT 2-1, DEPT. OF CONSUMER AFFAIRS AND ENVIRONMENT,
PROVINCE OF NEWFOUNDLAND AND LABRADOR.
2. HYDROGEOLOGY OF THE HUMBER VALLEY AREA.
WATER RESOURCES REPORT 2-5, GROUNDWATER SERIES, NEWFOUNDLAND AND
LABRADOR DEPARTMENT OF ENVIRONMENT.
3. HYDROGEOLOGY OF THE AVALON PENINSULA AREA.
NEWFOUNDLAND AND LABRADOR DEPARTMENT OF ENVIRONMENT, IN PRESS.

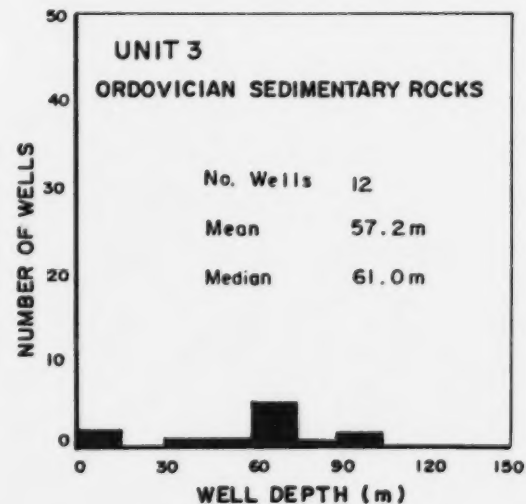
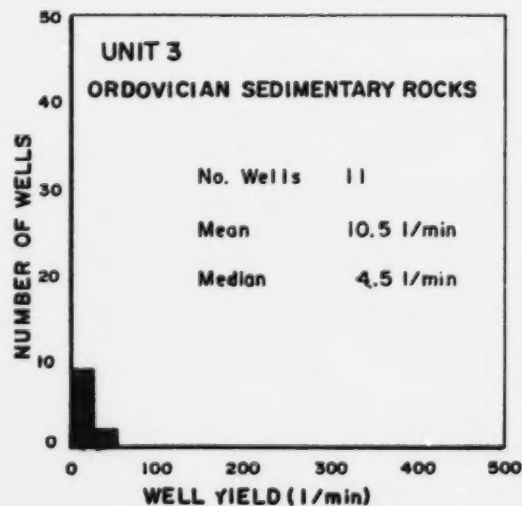
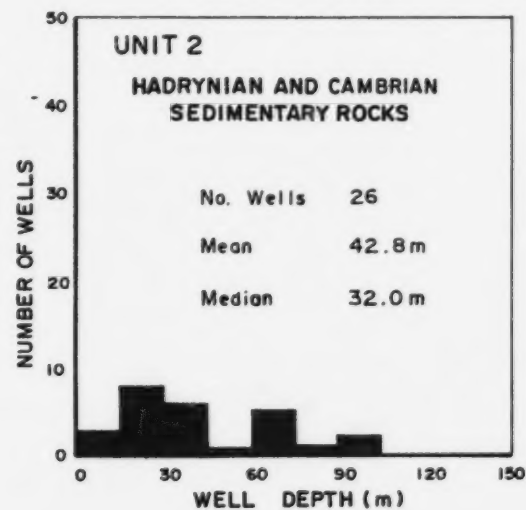
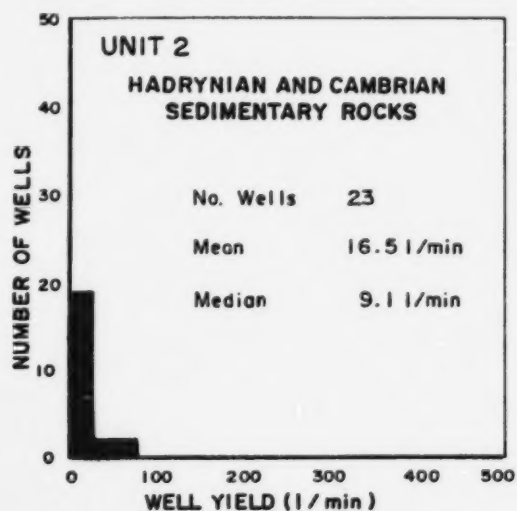
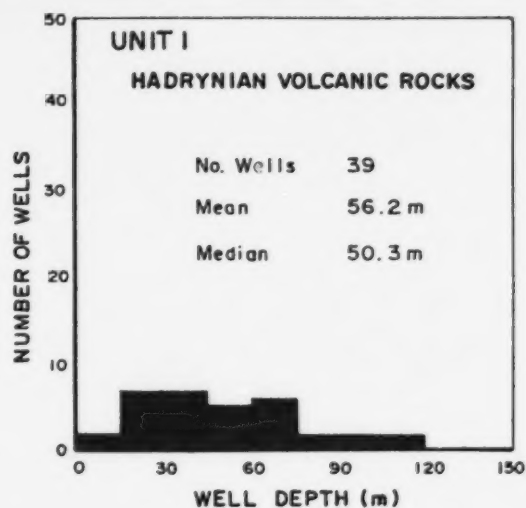
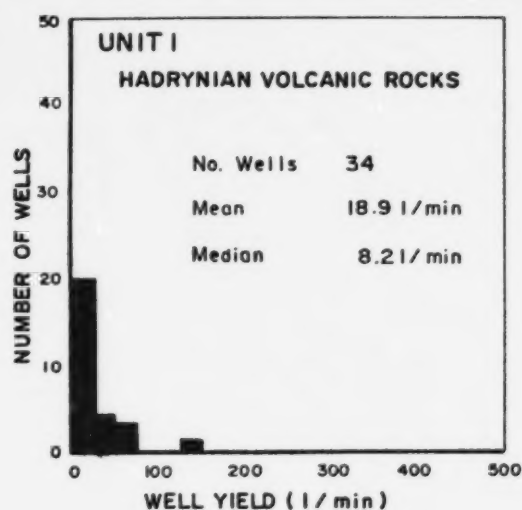
TABLE 4

BEDROCK HYDROSTRATIGRAPHIC UNITS, BURIN PENINSULA AREA, NEWFOUNDLAND

Hydrostratigraphic Unit	Lithology	Total No. of Wells	Well Yield Characteristics				Well Depth Characteristics			
			No. of Wells	Range L/min. (gpm)	Mean L/min. (gpm)	Median L/min. (gpm)	No. of Wells	Range m (ft.)	Mean m (ft.)	Median m (ft.)
UNIT 1 Hadyrnian Volcanic Rocks	Felsic and mafic volcanic flows and pyroclastics	39	34	0-136.4 (0-30)	18.4 (4.2)	8.2 (1.8)	39	4.3-152.4 (14-500)	56.2 (184.4)	50.3 (165.0)
UNIT 2 Hadyrnian and Cambrian Sedimentary Rocks	Sandstone, siltstone, shale, slate	27	23	2.3-68.2 (0.5-15.0)	16.5 (3.6)	9.1 (2.0)	26	13.7-103.6 (50-340)	42.8 (140.4)	32.0 (105.0)
UNIT 3 Ordovician Sedimentary Rocks	Shale, siltstone, slate, phyllite, schist	12	11	0-40.9 (0-9.0)	10.5 (2.3)	4.5 (1.0)	12	9.1-99.1 (30-325)	57.2 (187.7)	61.0 (200.1)
UNIT 4 Devonian Carboniferous Sedimentary Rocks	Conglomerate, sandstone	30	30	2.3-545.5 (0.5-120.0)	38.2 (8.4)	9.1 (2.0)	28	13.7-76.2 (50.0-250)	34.9 (114.5)	19.8 (65.0)
UNIT 5 Hadyrnian to Devonian Granitic and Gneissic Rocks	Diorite, granodiorite, granite, gabbro, ortho and paragneiss	6	4	2.3-136.4 (0.5-30.0)	44.9 (9.9)	20.5 (4.5)	6	12.2-109.7 (40-360)	43.4 (142.4)	23.4 (76.8)
UNIT 6 Carboniferous, St. Lawrence Granite and Grand Beach Porphyry Rocks	Alaskite granite, rhyolite porphyry	13	11	2.3-136.4 (0.5-30.0)	31.6 (7.0)	13.6 (3.0)	13	19.8-114.3 (65-375)	48.6 (159.4)	38.1 (125.0)

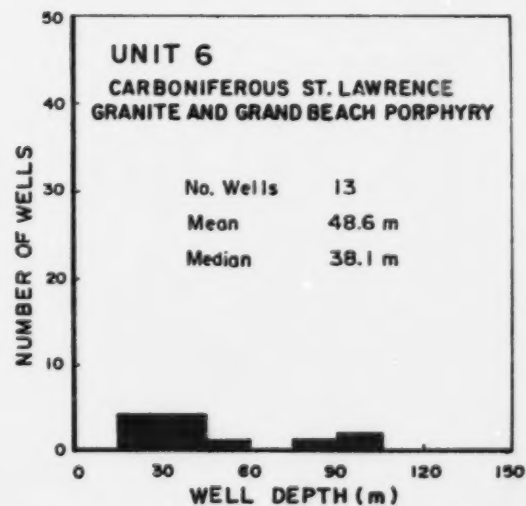
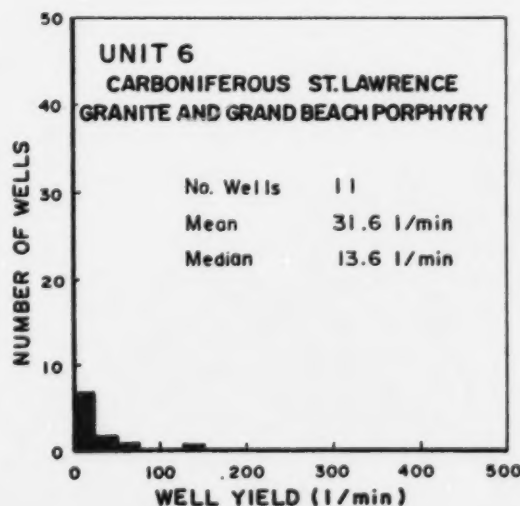
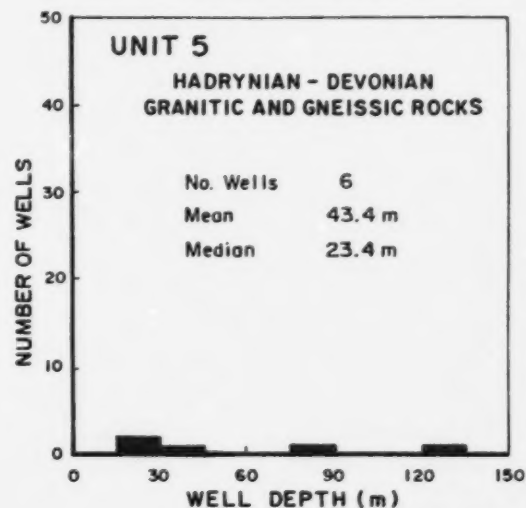
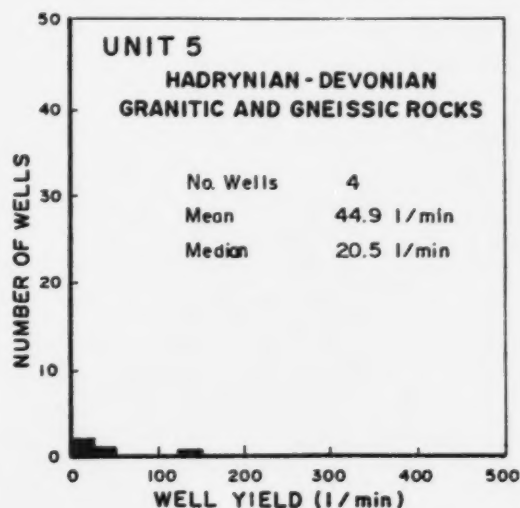
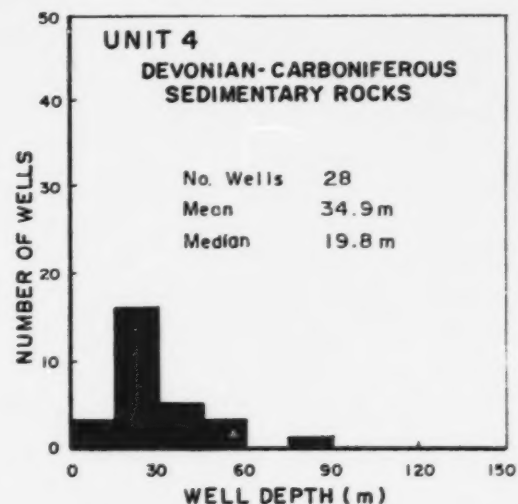
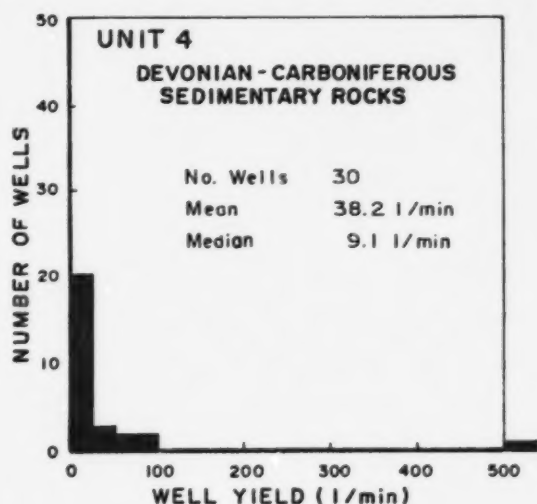
**WELL YIELD AND DEPTH RELATIONSHIPS
HYDROSTRATIGRAPHIC UNITS 1,2 & 3
BURIN PENINSULA AREA, NEWFOUNDLAND**

FIGURE 5



**WELL YIELD AND DEPTH RELATIONSHIPS
HYDROSTRATIGRAPHIC UNITS 4,5&6
BURIN PENINSULA AREA, NEWFOUNDLAND**

FIGURE 6



The six hydrostratigraphic units include: Unit 1-Hadrynian Volcanic Rocks, Unit 2-Hadrynian and Cambrian Sedimentary Rocks, Unit 3-Ordovician Sedimentary Rocks, Unit 4-Devonian and Carboniferous Sedimentary Rocks, Unit 5-Hadrynian and Devonian Granitic and Gneissic Rocks and Unit 6-Carboniferous St. Lawrence Granite and Grand Beach Porphyry Rocks.

The description of rock type provided in the well records is of limited value, therefore the bedrock encountered by the wells in each community was considered to be the rock type indicated to underlie the community as shown on Map 2. The hydrostratigraphic unit assigned to each well is shown on the water well records in Appendix II. It should be noted that well records reported for a community may not be located exactly within the community. Therefore some of the reported wells may not actually be completed within the assigned hydrostratigraphic unit indicated to underlie the community.

Based on the available data, the occurrence of groundwater within the bedrock hydrostratigraphic units is almost entirely dependent on secondary permeability. Primary permeability within the comparatively unmetamorphosed sedimentary and volcanic strata, related to intergranular porosity, has largely been eliminated by the effects of deep burial and metamorphism. However, primary permeability may be significant in addition to secondary permeability within the Devonian sedimentary strata of Unit 4. The secondary permeability features include open jointing and bedding planes within the rock and fractured zones related to faulting. Accordingly, it is these features that provide groundwater to drilled wells within the bedrock.

The major linear fault structures that traverse the study area in a southwest to northeast direction (see Map 2) may be associated with zones of extensive fracturing with potentially high groundwater yield. These features are not included within the hydrostratigraphic unit subdivisions but should be regarded as areas of potentially good groundwater sources.

6.1.2.1 Unit 1 - Hadrynian Volcanic Rocks

Hadrynian volcanic rocks underlie much of the Burin Peninsula and Fortune Bay area. These rocks are lithologically similar throughout this area and have undergone similar deformational histories including greenschist regional metamorphism, folding and faulting.

A total of 39 wells were located within Unit 1, most of which are located in the Marystown to Lamaline area. The well data indicates that the rock strata of Unit 1 has a low to moderate yield. The well yield varied from 0 to 136.4 L/min. encountered at depths of 4.3 to 152.4 m. The mean well yield was 18.4 L/min. while the median yield was 8.2 L/min. from a median depth of 50.3 m. The available data indicates that strata within Unit 1 are capable of producing a moderate to good water supply adequate for domestic purposes.

6.1.2.2 Unit 2 - Hadrynian and Cambrian Sedimentary Rocks

The Hadrynian and Cambrian sedimentary rocks occur in limited areas of the Burin Peninsula and Fortune Bay areas. The sediments tend to be fine grained and they have been subjected to the same greenschist metamorphism, folding and faulting as the underlying Hadrynian volcanics.

Twenty-seven wells were identified within this unit. The yield obtained from these wells ranged from 2.3 to 68.2 L/min. obtained from depths of 13.7 to 103.6 m. The mean yield is 16.5 L/min. and the median yield is 9.1 L/min. from a median depth of 32 m. The well data indicates that the sedimentary strata of Unit 2 has a moderate well yield similar to that of the volcanic strata of Unit 1. Again, these strata are capable of producing a moderate to good water supply for domestic purposes.

6.1.2.3 Unit 3 - Ordovician Sedimentary Rocks

A limited amount of well data is available for the Ordovician sedimentary rocks of the Baie D'Espoir Group. A total of 12 wells were identified within this unit with yields ranging from 0 to 40.9 L/min. from a depth range of 9.1 to 99.1 m. Both the mean and median well yields are low, 2.3 and 1.0 L/min. respectively from a median depth of 61 m. Unit 3 apparently has a low well yield potential based on the available data. This is in accord with the fine grained, shaly nature of these rocks.

6.1.2.4 Unit 4 - Devonian and Carboniferous Sedimentary Rocks

Devonian sedimentary strata occur along the northwest shore of Fortune Bay and Carboniferous strata occur locally near Terrenceville. The strata are predominantly thickly bedded conglomerate and sandstone. They overlie Hadrynian and Cambrian strata in angular unconformity and have not been subjected to significant regional metamorphism. Consequently, these strata may possess some degree of primary permeability related to intergranular porosity in addition to secondary fracture permeability.

TABLE 7

GROUNDWATER CHEMISTRY OF OVERBURDEN WELLS
BURIN PENINSULA AREA, NEWFOUNDLAND

CONSTITUENT*	BURIN	LITTLE ST. LAWRENCE	MORTIER	LITTLE BAY HARVISTOWN	BURIN DISTRICT	ENGLISH HARBOUR E.	LAMALINE	RECONTE EAST	ROCK HARBOUR
Conductivity (umhos/cm)	-	120.88	-	-	112	-	-	229.80	75
pH (pH units)	4.703	8.10	-	-	6.29	-	-	28.6	6.53
Na	-	-	390	150.56	26.5	-	-	1.874	-
K	-	-	-	-	-	17.6	-	8.23	2.86
Ca	-	8.41	-	-	7.17	1.74	-	1.225	1.13
Mg	-	2.286	-	-	2.16	25	-	-	-
Cl	14	-	684	161	76	0.07	250	0.067	0.02
Fe	-	0.052	-	-	0.21	<0.01	-	0.01	<0.01
Mn	-	<0.01	-	-	0.03	<0.01	-	4.03	<0.01
Zn	-	0.106	-	-	0.48	-	-	0.070	0.006
Cu	-	0.035	-	-	0.11	-	-	-	<0.001
Cd	-	0.01	-	-	0.0001	-	-	0.013	-
Pb	-	-	-	-	-	-	-	0.125	-
F	-	0.286	-	-	-	0.06	-	<1	-
Al (total)	-	0.057	-	-	0.048	-	-	-	0.091
Salt (NaCl)	-	-	-	-	-	-	-	-	-
NO ₃ - (as N)	12	0.295	-	-	0.031	-	0.160 0.070 0.280 0.050	4.95	0.023
Kjeldahl N	-	0.120	-	-	0.260	5	-	-	0.37
Sulfate	-	-	-	-	-	-	-	-	-
Hydrogen Sulfide	-	-	-	-	-	-	-	-	-
Alkalinity (as CaCO ₃)	-	75.8	-	-	18	-	-	-	4.6
Hardness (as CaCO ₃)	-	30.50	-	-	27.2	-	-	25.72	11.8
Acidity	-	<5	-	-	15	-	-	-	15
Apparent Colour	-	0.42	-	-	1.6	-	-	-	0.38
Turbidity	-	13	-	-	10	-	-	-	8
Chemical Oxygen Demand	-	-	-	-	-	-	-	-	-
Total Nitrogen	-	-	-	-	-	-	-	-	-
Total Organic Carbon	-	-	-	-	-	-	-	-	-
HCO ₃ ⁻ and CO ₃ ²⁻	-	-	-	-	-	-	-	-	-
Cl and NO ₃ ⁻	-	-	-	-	-	-	-	-	-

*Concentrations in mg/L except where noted.

A total of 30 wells are located within these strata, the majority being in the community of English Harbour West. The wells have a broad range of yields from 2.3 to 545.5 L/min. obtained from comparatively shallow depths of 13.7 to 76.2 m. The mean and median well yields are 38.2 and 9.1 L/min. respectively from a median depth of 19.8 m. The one high yielding well (545.5 L/min.) was drilled for the school board in English Harbour West. The well was cased into rock and completed to a depth of 52 m. Three other wells within the area yielded 68 to 90 L/min. from depths of 13.7 to 42.7 m. The high yields obtained from comparatively shallow well depths may be related to zones of primary permeability within the rock. As such, the Devonian- Carboniferous strata may in part constitute potentially high yield aquifers. Therefore, it is considered that Unit 4 has a moderate to high well yield potential for both domestic and municipal purposes

6.1.2.5 Unit 5 - Hadrynian and Devonian Granitic and Gneissic Rocks

Granitic rocks of Unit 5 occur extensively throughout the northern half of the study area. Due to the general remoteness of the areas underlain by granite, these areas are sparsely populated.

The yield of the six wells located within Unit 5 ranged from 2.3 to 136.4 L/min. from depths of 12.2 to 109.7 m. The mean yield was 44.9 L/min. and the median yield was 20.5 L/min. from a depth of 23.4 m. The low to moderate yields indicated by these wells are considered adequate for domestic water supplies only. It is considered that the yields indicated for these granites are somewhat high considering the massive, generally undeformed, nature of the rocks. It may be more reasonable to consider the potential well yield within this unit as being low.

The data indicates that the water is generally fresh and soft, with low concentrations of metals. The concentrations of metals and nitrates are generally within acceptable water quality criteria, although one of the wells from the Burin District has concentrations of iron and manganese of 7.12 mg/L and 5.15 mg/L, which are above the recommended levels of 0.3 and 0.05 mg/L, respectively. Although it is not a health problem, elevated levels of iron and manganese will tend to result in aesthetic problems due to staining. Water of this nature is commonly associated with areas of bog. The two wells at Little Bay - Marystown have relatively high sodium concentrations (390 and 150.56 mg/L), which probably indicate sea water contamination or the effect of road de-icing salt.

In summary, the surficial deposits appear to provide good quality groundwater, although road de-icing salt or salt water contamination can be a problem. The major ionic constituents are calcium, magnesium and carbonate, with occasional elevated concentrations of manganese and iron.

6.4.2 Bedrock Groundwater Quality

Water quality data from wells completed in bedrock are available for 25 public and private drilled wells from Lamaline, Rushoon, Little Bay East, Red Harbour, Winterland and Frenchman's Cove as shown in Table 8.

The data indicate that the water is soft to very hard and is similar to that in the overburden. Most of the wells have manganese concentrations greater than the recommended level of 0.05 mg/L. Manganese concentrations range from 0.02 to 1.0 mg/L. A few of the wells also have iron concentrations above the recommended level of 0.3 mg/L. Iron concentrations range from 0.01 to 5.7 mg/L. As previously mentioned, elevated concentrations of these metals tend to cause

6.1.2.6 Unit 6 - Carboniferous St. Lawrence Granite and Grand Beach Porphyry Rocks

A total of 13 wells identified within the St. Lawrence Granite indicate a range of well yields from 2.3 to 136.4 L/min. from depths of 19.8 to 114.3 m. The mean and median yields of these wells are a moderate 31.6 and 13.6 L/min. respectively.

The St. Lawrence Granite is well known for yielding high volumes of groundwater mainly from the experiences of the fluorspar mines (Nolan and Associates Ltd., 1971). The Director Mine in St. Lawrence required continuous pumping of water at a rate of 9464 L/min. to keep the mine dewatered. Efforts at groundwater control including grouting and redirection of surface water drainage proved ineffectual in reducing the inflows. The water was fresh and entered the mine workings from open fractures within both the ore veins and the host granite. Compared to other rock strata within the study area, the St. Lawrence Granite is extensively fractured.

The Town of St. Lawrence obtained its municipal water supply for many years from a drilled well. The well supplied 568 L/min. to service a community of 2130 people (Shawinigan Engineering et al, 1968). Interestingly, this high yielding well was located within 15 m of the harbour shoreline and was not affected by salt water intrusion (Nolan and Associates, 1971). However, salt contamination did periodically occur due to surface flooding of the well at exceptionally high tides (Shawinigan Engineering et al, 1968).

TABLE 8
GROUNDWATER CHEMISTRY OF BEDROCK WELLS
BURIN PENINSULA AREA, NEWFOUNDLAND

Constituent*	Lamaline	Rushoon	Red Harbour	Winterland
Conductivity (umhos/cm)	386.56	242.0	266.77	215
pH (pH Units)	7.50	6.71	7.7	7.63
Na	-	-	-	-
K	-	-	-	-
Ca	52.95	21.31	3.78	27.0
Mg	4.281	1.394	0.530	4.59
Cl	-	-	-	-
Fe	5.7	0.080	0.01	0.022
Mn	0.63	0.057	0.306	0.029
Zn	1.886	0.942	0.244	<0.01
Cu	.114	0.040	0.054	0.01
Cd	<0.01	0.01	0.01	<0.0001
Pb	-	-	-	-
F	-	-	-	-
Al	-	-	-	-
P (Total)	0.072	0.070	0.017	<0.005
Salt (NaCl)	-	-	-	-
NO ₃ - (As N)	<0.005	<0.005	<0.005	1.9
Kjeldahl N	0.230	0.214	0.116	0.06
Sulfate	-	-	-	-
Hydrogen Sulfide	-	-	-	-
Alkalinity (As CaCO ₃)	114.6	25.8	59	59
Hardness (As CaCO ₃)	151.22	59.17	12.18	86.4
Acidity	-	-	-	-
Apparent Colour	160	7.5	7.5	5
Turbidity	9.4	1.42	0.9	0.29
Chemical Oxygen Demand	16.21	0.54	11.4	9
Total Nitrogen	-	30	15	-
Total Organic Carbon	-	-	-	-
HCO ₃ ⁻ and CO ₃ ²⁻	-	-	-	-
Cl and NO ₃	-	-	-	-

* Concentrations in mg/L except where noted

Based on the mine's experiences and the high yield of the water supply wells, the St. Lawrence Granite is considered to have a high groundwater yield potential, however, the water may not be potable due to fluoride and radon gas (see Section 6.4 of this report). These concerns led to the eventual abandonment of the municipal well in St. Lawrence.

The Grand Beach Complex located on the opposite side of the Burin Peninsula from St. Lawrence is comprised of felsic volcanic porphyry with interbedded pyroclastics, sediments and mafic volcanic flows and agglomerates. The complex dips seaward towards Fortune Bay. Exploration diamond drilling within the Grand Beach Complex encountered groundwater and several boreholes flowed under artesian conditions (O'Brien, personal communication, 1985). The artesian spring water was reported to be used by local residents.

It is considered that the Grand Beach Complex may have a moderate to high potential groundwater yield. The groundwater bearing strata may be bedded sequences of sedimentary rock or volcanic pyroclastics within the otherwise massive porphyritic rocks of the complex.

6.2 Groundwater Flow Systems

On a regional basis the hydrogeology of the Burin Peninsula study area can be subdivided into several shallow groundwater flow systems superimposed on two deep groundwater flow systems.

TABLE 8 (Cont'd)

GROUNDWATER CHEMISTRY OF BEDROCK WELLS
BURIN PENINSULA AREA, NEWFOUNDLAND

Constituents*	Frenchman's Cove			Matyslow	Burin	St. Lawrence	Little Bay East
Conductivity (umhos/cm)	-	-	220	230			
pH (pH Units)	6.19	-	7.34	7.26			
Na	-	-	-	-			
K	-	-	-	-			
Ca	5.66	-	5.96	6.12	50.90	105 9.9 73.8	
Mg	-	-	5.56	5.91	7.05	93.4 2.5 70.4	62.12
Cl	-	-	-	-		1.7 1.6 2.4	0.50
Fe	-	-	4.97	0.17			
Mn	-	-	0.05	0.02			
Zn	0.25	-	0.02	0.01			
Cu	-	-	0.03	< 0.01			
Cd	-	-	< 0.005	< 0.005			
Pb	-	-	-	-			
F	-	-	-	-			
Al	-	-	-	-			
P (Total)	-	-	0.398	0.412			
Salt (NaCl)	-	-	-	-			
NO ₃ - (As N)	-	-	0.410	0.101			
Kjeldahl N	-	-	0.65	0.31			
Sulfate	-	-	-	-			
Hydrogen Sulfide	-	-	-	-		0.0 9.6 3.9	
Alkalinity (As CaCO ₃)	13	-	30	31			0.006
Hardness (As CaCO ₃)	-	-	38.1	40			
Acidity	-	-	-	-			
Apparent Colour	-	-	5	5			
Turbidity	-	-	0.44	0.55			
Chemical Oxygen Demand	-	-	-	-			
Total Nitrogen	-	-	-	-			
Total Organic Carbon	-	-	-	-			
HCO ₃ ⁻ and CO ₃ ²⁻	-	-	-	-			
Cl and NO ₃	-	-	-	-		122 3.3 48.6	
	-	-	-	-		259 15.7 179.1	

* Concentrations in mg/L except where noted

6.2.1 Shallow Flow Systems

The shallow groundwater flow systems are associated with the circulation of fresh groundwater in the surficial deposits and the shallow bedrock. Water table conditions and local topography are the main controls on these flow systems. In this context, the "water table" forms the upper limit of entirely saturated rock and surficial overburden deposits from which water can be obtained. The water table is located below ground surface in the upland areas which form zones of groundwater recharge. In these areas, precipitation infiltrates downwards to the water table to enter the shallow groundwater flow systems. The water table locally intersects the ground surface in the various wet lowland areas, ponds, lakes and along stream courses in the study area. These locations form zones of groundwater discharge, where groundwater is introduced to the surface drainage system to form base flow in the streams. Groundwater will flow in the direction of slope of the water table from areas of higher to lower elevation.

Regionally, the water table elevation is considered to vary in direct relationship to the surface topography. Consequently, the recharge divides of the shallow groundwater flow systems tend to coincide with surface drainage basin divides. Similarly, groundwater discharge divides will tend to coincide with stream courses where groundwater recharging from each side of the drainage basin is discharged as baseflow.

In the shallow flow systems, groundwater follows a relatively short flow path from areas of recharge to discharge. Consequently, the residence time of the water in the subsurface environment is short and the water quality is generally fresh.

6.2.2 Deep Flow Systems

Water that enters deep within the rock formations of the study area will flow in response to regional hydraulic gradients. These gradients reflect the regional topographic slope from upland recharge areas to regional discharge areas which are associated with the coastline within the study area. The regional hydraulic gradient is less affected by local topographic variations than are local hydraulic gradients in shallow flow systems.

The groundwater in the deep flow systems is recharged from the shallow systems. Once in a deep flow system, the groundwater is considered to flow to the ultimate discharge zones at the coastal perimeters of the study area. There are considered to be two deep flow zones within the study area, one beneath the Burin Peninsula itself and one beneath the portion of the study area north of Fortune Bay. The major deep groundwater flow paths will follow significant fractured zones, such as along major fault structures.

The groundwater flow paths are relatively long with accordingly long residence time for the groundwater in the rock. These factors lead to increased concentrations of total dissolved solids in the groundwater through dissolution of rock forming minerals, especially carbonate, sulphate and halide mineralization. In a regional groundwater flow system, the order of increase in total dissolved solids usually follows an evolutionary trend along the flow path from bicarbonate water to sulphate water and finally to chloride water (Freeze & Cherry, 1979).

Significant groundwater flow has been detected at depths of up to 300 m in the Carboniferous St. Lawrence granite in the fluorite mines at St. Lawrence. It was noted in the Director Mine that the total dissolved solids of the groundwater inflows increased below a depth of 120 m. This depth may reflect the separation between the fresh shallow flow system and the deep flow system within this immediate area.

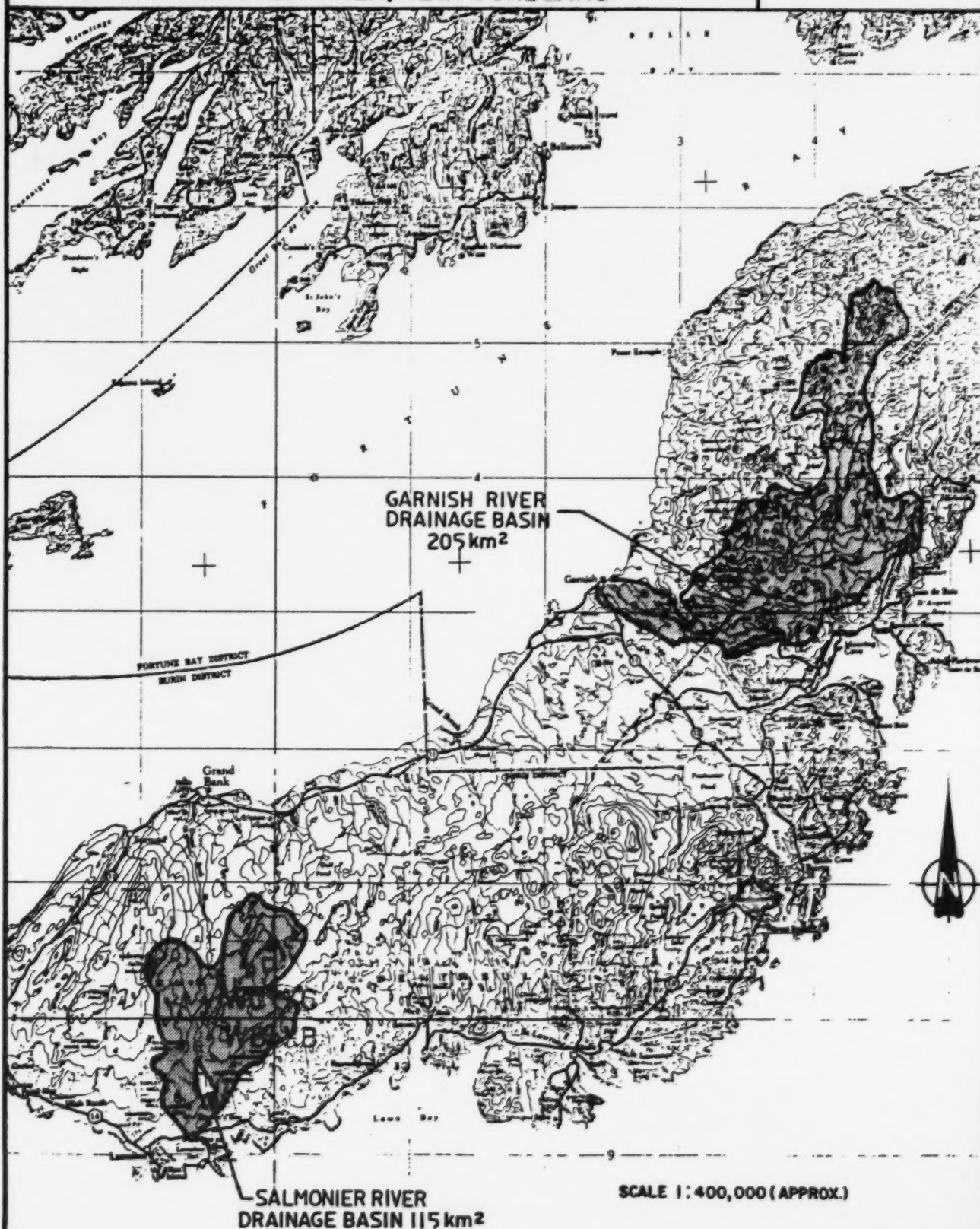
6.3 Groundwater Recharge

The quantity of groundwater recharge that occurs within the Burin Peninsula area has been assessed by examining the baseflow discharge of the Garnish River and Salmonier River drainage basins for the period of 1982 and 1983. The extent of the drainage basins are shown in Figure 7. The drainage from these basins is unregulated by dams or other water control structures and it is monitored daily by Environment Canada at the hydrometric stations on the Garnish River near Garnish and on the Salmonier River near Lamaline. The data is published in the report "Surface Water Data, Atlantic Provinces, 1982 and 1983 (Environment Canada, 1984). The hydrographs for the 1982 and 1983 daily flow data from both drainage basins are shown in Figure 8.

The volume of groundwater that is recharged to a drainage basin can be approximated by the basin's baseflow discharge. The separation of the baseflow component of the hydrographs as shown in Figure 8 provides an indication of the amount of water that is recharged to the respective basins. The baseflow discharge is separated from the hydrographs by joining the base of the peaks of the total stream flow in a manner which depends on the hydrograph

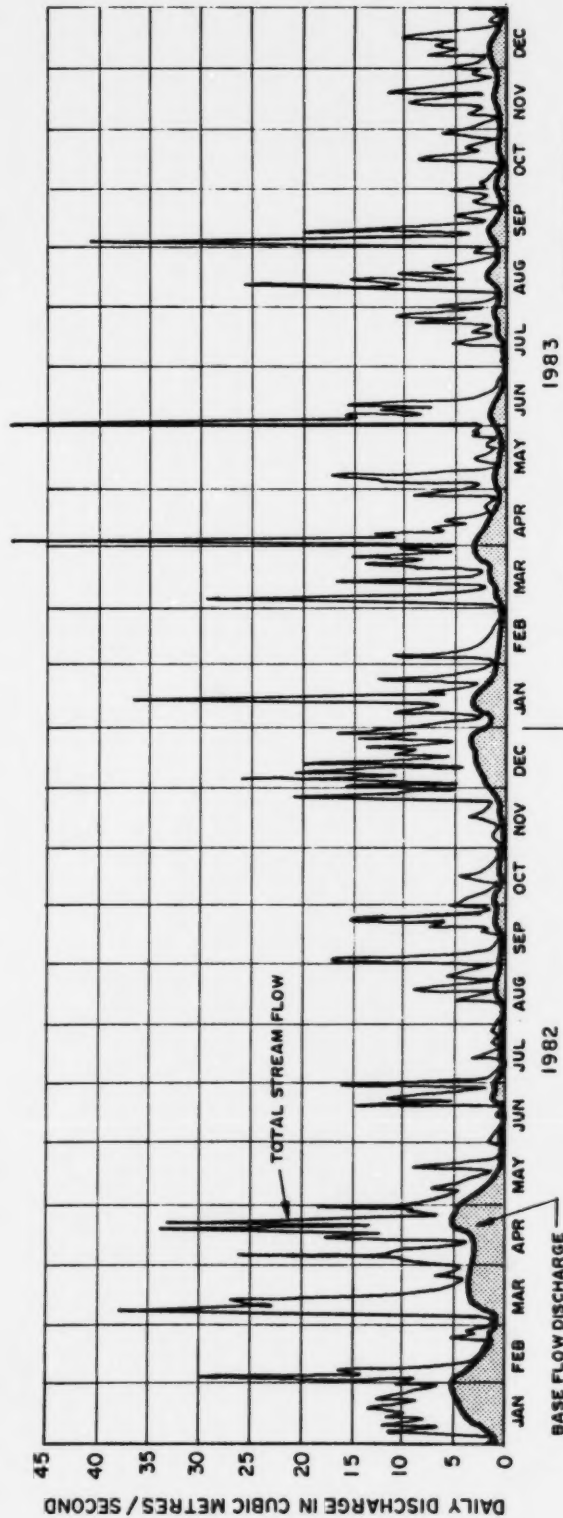
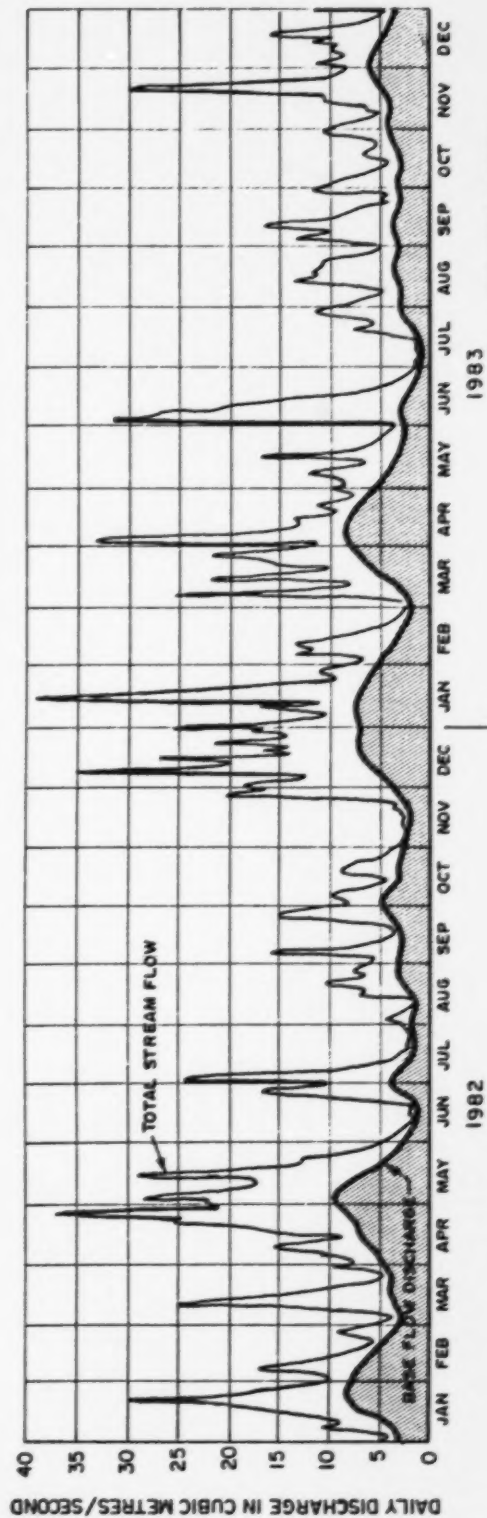
**WATERSHED BOUNDARIES FOR
GARNISH AND SALMONIER RIVER BASINS
BURIN PENINSULA AREA, NEWFOUNDLAND**

FIGURE 7



STREAM FLOW HYDROGRAPHS FOR GARNISH AND SALMONIER RIVER BASINS BURIN PENINSULA AREA, NEWFOUNDLAND

FIGURE 8



DATA OBTAINED FROM: ENVIRONMENT CANADA 1984. SURFACE WATER DATA, ATLANTIC PROVINCES 1982, 1983 INLAND WATERS DIRECTORATE,
WATER RESOURCES BRANCH, OTTAWA CANADA, 1984.

trends (see Freeze and Cherry, 1979). It should be noted that the baseflow discharge represented by the hydrographs includes both groundwater discharge and the slow release of surface water to the stream from storage in lakes and bog areas.

The sharp peaks shown on the hydrographs of Figure 8 represent surface water runoff. The main peak flow period observed in the months of April and May represents spring snowmelt and the other peaks represent periods of heavy rainfall. The hydrograph separations indicate that the 1982 and 1983 baseflow component of the Garnish River drainage basin was approximately 40 percent of the total flow, whereas the baseflow component of the Salmonier River was 27 percent. The larger baseflow indicated within the Garnish River Basin may be related to the larger area of lakes, ponds and bogs within the basin which could augment the baseflow through the release of surface water storage.

The total amount of precipitation that fell on the river basins for the hydrographic periods of 1982 and 1983 was 3.798 m based on the Environment Canada Data from the weather station at St. Lawrence. This station was the only operating station within the study area for the period.

A comparison of the total precipitation, stream discharge and baseflow can be used to provide an indication of the water balance of the river basins as summarized in Tables 5 and 6. The estimated recharge to the Garnish River and Salmonier River Drainage Basins is 33.6 and 22.9 per cent of the total precipitation respectively. Although these estimates are affected by surface water storage, they provide an indication of the amount of precipitation that is potentially available as groundwater.

TABLE 5

WATER BALANCE 1982 - 1983
 GARNISH RIVER DRAINAGE BASIN
BURIN PENINSULA AREA, NEWFOUNDLAND

Basin Area	$2.05 \times 10^8 \text{ m}^2$	
Total Discharge	$6.54 \times 10^8 \text{ m}^3$	
Baseflow ⁽¹⁾	40 Percent (of total discharge)	
Precipitation	3.798 m	
Total Precipitation on Basin	$7.79 \times 10^8 \text{ m}^3$	100.0%
Evapotranspiration	$1.25 \times 10^8 \text{ m}^3$	16.0%
Recharge	$2.62 \times 10^8 \text{ m}^3$	33.6%
Runoff	$3.92 \times 10^8 \text{ m}^3$	50.4%

NOTE: (1) Baseflow includes surface storage release and groundwater discharge.

TABLE 6

WATER BALANCE 1982 - 1983
 SALMONIER RIVER DRAINAGE BASIN
BURIN PENINSULA AREA, NEWFOUNDLAND

Basin Area	$1.15 \times 10^8 \text{ m}^2$	
Total Discharge	$3.71 \times 10^8 \text{ m}^3$	
Baseflow ⁽¹⁾	27 Percent (of total discharge)	
Precipitation	3.790 m	
Total Precipitation on Basin	$4.37 \times 10^8 \text{ m}^3$	100.0%
Evapotranspiration	$6.60 \times 10^7 \text{ m}^3$	15.1%
Recharge	$1.00 \times 10^8 \text{ m}^3$	22.9%
Runoff	$2.71 \times 10^8 \text{ m}^3$	62.0%

NOTE: (1) Baseflow includes surface storage release and groundwater discharge.

6.4 Groundwater Quality

Groundwater quality data for the Burin Peninsula area consists of analyses from public and private dug and drilled wells provided by the Department of Environment. The location of communities with available water quality data is shown on Figure 9. In addition to the general composition of the water, the available chemical data from the study area has been compared to Health and Welfare Canada (1978) drinking water criteria to assess the acceptability of the various groundwater supplies.

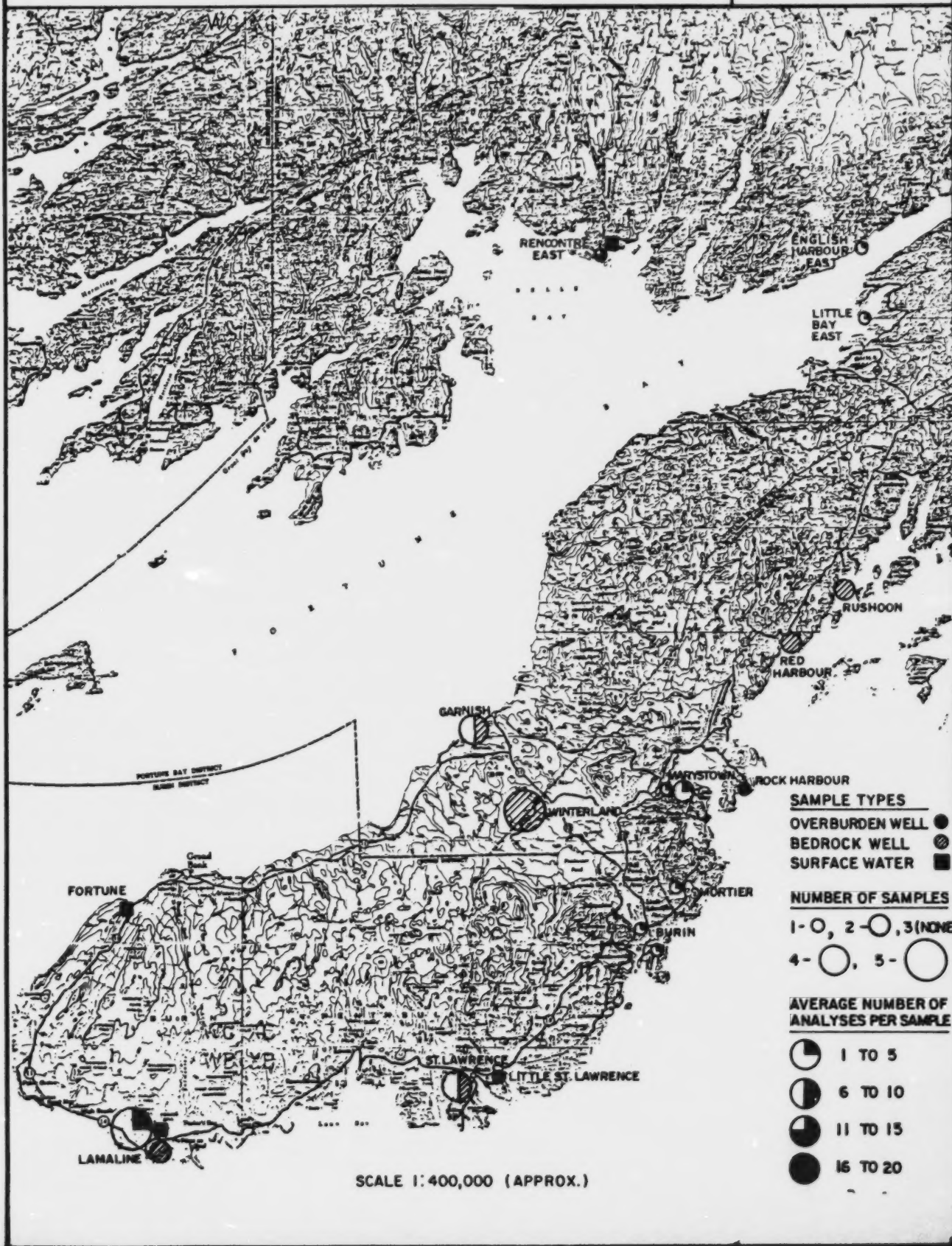
It was not possible to determine the analytical precision of the results by calculating the charge balance errors because the individual water analyses are incomplete and do not include analyses of some of the major cation and anion species, such as chloride, sulphate, bicarbonate sodium and magnesium. Details concerning the methods of filtration and preservation of the samples prior to analyses were also not available. It is assumed that the chemical analyses presented are representative of in situ groundwater.

6.4.1 Overburden Groundwater Quality

Water quality data for wells completed in tills and sands and gravels is available for 13 shallow domestic wells in Burin, Little St. Lawrence, Mortier, Marystown, English Harbour East and Lamaline and from a communal well in Rock Harbour. The data is presented in Table 7.

**GROUND WATER AND SURFACE WATER CHEMISTRY DATA
AVAILABILITY
BURIN PENINSULA AREA, NEWFOUNDLAND**

FIGURE 9



staining problems, however, the concentrations encountered in bedrock wells are noticeably less than those in overburden wells. The very hard water is found in the two wells from Lamaline, which have hardnesses of 152 to 171 mg/L as CaCO_3 . One well from Red Harbour and one well from Winterland also have moderately hard water, with hardnesses of 98 mg/L and 86 mg/L, respectively. No data are available for sodium and chloride concentrations.

Based on the available data, there does not appear to be significant differences in major ion chemistry of well water obtained from the different rock types within the study areas. However, naturally high concentrations of fluoride in the groundwaters of the Burin Peninsula have been well documented, particularly in the St. Lawrence area. The fluoride is associated with the fluorspar mineralization within the St. Lawrence Granite. The highest concentrations are found in wells drilled into the bedrock, such as the municipal well for St. Lawrence, which has had fluoride concentrations of up to 4.3 ppm. Shawinigan Engineering (1968) reported that out of 21 private dug wells in the St. Lawrence area, sampled since 1960, 19 had fluoride concentrations above the recommended level of 1.0 ppm, and 13 above the maximum acceptable concentration of 1.5 ppm (Health and Welfare Canada, 1978). The range of concentrations was 0.68 to 4.3 ppm, with an average concentration of 2.26 ppm.

Elsewhere, out of 27 private dug wells sampled in August 1960 in the Little St. Lawrence, Burin, Lewin's Cove, Corbin, Lawn and Lord's Cove areas, only 1 well had a fluoride concentration above 1.5 ppm, and 2 above 1.0 ppm. The highest concentration was for one well in the Corbin area, which had a concentration of 2.4 ppm. This indicates that the fluoride problem seems to be largely restricted to the

St. Lawrence area. Some evidence of dental fluorosis is present in the population of St. Lawrence where water with the high fluoride content had been in use for more than ten years (Shawinigan Engineering et al, 1968).

Another problem in the St. Lawrence area is naturally high radon concentrations, which are derived from the radioactive decay of trace uranium mineralization in the granite bedrock. Cases of lung cancer related to radon exposure in the fluorspar mines in St. Lawrence have been documented and it is probable that the radon was being carried into the mines via the groundwater (Nolan and Associates Ltd., 1971). Concern for radon gas, and high fluoride concentrations in addition to mechanical problems resulted in the eventual abandonment of the municipal well in the community of St. Lawrence in 1971.

6.5 Groundwater Contamination

The groundwater in the area is generally of good quality based on the limited data available. Two of the shallow wells in Marystown show high levels of sodium and chloride, indicative of either road de-icing salt or sea water intrusion. The latter is often a problem with coastal drilled wells whose intakes are at an elevation below sea level or for wells close to the ocean which are overpumped enough to reverse the natural seaward hydraulic gradient. The municipal well in St. Lawrence was known to be affected periodically by salt water intrusion, with concentrations of sodium chloride as high as 600 ppm for short periods. As previously discussed, this was considered to be due to submergence of the well by exceptionally high tides since the well is within 15 m of the shoreline (Shawinigan Engineering et al, 1968).

Bacterial contamination of shallow dug wells is another cause for concern in small and rural communities. The source of the bacteria is usually poorly situated septic fields or outhouses, or domestic animal waste. Wells in the Recontre East and Winterland areas showed elevated nitrate levels which might also be related to a similar situation, however the nitrate levels were below recommended drinking water levels of 10 mg/L. Bacterial contamination is generally very localized, where the well is very close to the pollution source, and can be largely eliminated with deep, properly cased and sealed drilled wells.

Other possible sources of contaminants are petroleum leaks or spills, municipal landfill wastes and mine or industrial wastes. These can be a problem where water supplies are located down-gradient from the source of contamination, especially in relatively permeable aquifers, such as sands and gravels. There is no evidence of any such contamination in the analyses presented, but the potential for contamination always exists. Care in the placement of landfills, waste disposal sites and petroleum storage tanks and in the location of wells can greatly reduce the impact of groundwater contamination.

6.6 Surface Water Quality

Surface water quality data has been collected from the Environment Canada hydrometric station on the Garnish River near Garnish since 1971 (Environment Canada, 1982). A summary of the data from this station between the period September 4, 1971 and February 3, 1979 is listed in Table 9. Some additional surface water data, obtained from the Department of Environment files was available from the

TABLE 9

SUMMARY OF SURFACE WATER CHEMISTRYSEPT. 4, 1971 to FEB. 3, 1979GARNISH RIVER NEAR GARNISHBURIN PENINSULA AREA, NEWFOUNDLAND

Constituent*	Low	High	Average
Conductivity $\mu\text{mhos/cm}$	22	145	49
pH (pH units)	4.8	7.1	-
Na (dissolved)	2.4	19.0	5.7
K (dissolved)	.1	4.0	.4
Ca (dissolved)	.7	3.0	1.99
Mg (dissolved)	.3	2.3	.8
Cl (dissolved)	4.0	35.0	10.2
Fe (total)	.118	.214	.153
Mn (total)	<.01	.031	.020
Zn (total)	<.01	.03	.02
Cu (total)	<.01	<.01	-
Cd (total)	<.01	<.01	-
Cr (total)	.01	.01	-
Ni (total)	<.01	<.01	-
Pb (total)	.01	.011	.011
F (dissolved)	<.05	.27	.08
P (total)	.001	.07	.0103
NO ₃ - (as N) (dissolved)	<.005	.005	-
Kjeldahl N (total)	.1	.3	.2
Sulfate (dissolved)	1.1	9.8	3.9
Bicarbonate	<.5	9.5	3.2
Hardness (as CaCO ₃)	3.1	17.0	8.2
Acidity	-	-	-
Apparent Colour	5	>100	44
Turbidity	<.1	3.1	.6
Chemical Oxygen Demand	20	34	29
Total Organic Carbon	6.4	6.4	-
Coliforms (total) MF Number per 100 ML	120	220	160
Coliforms (fecal) MF Number per 100 ML	<10	30	20

*Concentrations in mg/L except where noted.

Reference: Environment Canada, 1982,
 Water Quality Data, Newfoundland, 1965-1980
 Inland Waters Directorate, Atlantic Region, Water
 Quality Branch, Ottawa, Canada 1982

Salmonier River near Lamaline and a pond in Recontre East and an analyses of water from Fortune Brook near the town of Fortune was obtained from the Water Resources Study of the Province of Newfoundland (Shawinigan Engineering et al., 1968). These data are listed on Table 10.

The water from the Garnish River was very soft and the dominant major ions were sodium (average 5.7 mg/L) and chloride (average 10.2 mg/L) (see Table 9). The dominance of these two ions is characteristic of an area receiving precipitation in close proximity to the ocean. The concentration of heavy metals in the Garnish River (Table 9) and the Salmonier River, Fortune Brook and Recontre East pond (Table 10) were all within Federal and Provincial drinking water quantity standards. However, the water in the Garnish River near Garnish was contaminated with both total coliform and fecal coliform bacteria such that at the sample location, it was not fit for drinking. The bacterial contamination was persistent over the years sampled and was probably related to sewage runoff from the Town of Garnish. This situation probably did not occur within the river upstream of the community.

A large porportion of the dissolved solids within the surface water are derived from groundwater discharged to the river basins. The main dissolved solids from groundwater include calcium, bicarbonate (alkalinity) and sulphate in addition to sodium and chloride which can be derived from both groundwater discharge and precipitation. The concentration of the dissolved solids within the surface water will tend to be highest during periods of low precipitation when the flow within the streams is largely derived from groundwater discharge and correspondingly lowest during period of high precipitation.

TABLE 10

SURFACE WATER CHEMISTRY

BURIN PENINSULA AREA, NEWFOUNDLAND

Constituent**	Lamaline Salmonier River	Rencontre East Pond	Fortune Brook*
Conductivity	167.93	27.06	50
pH (pH units)	6.60	5.33	6.4
Na	-	-	5.5
K	-	-	0.3
Ca	2.63	1.10	1.8
Mg	0.915	0.341	0.7
Cl	-	-	10.0
Fe	0.116	0.100	0.10
Mn	0.018	0.015	0.0
Zn	0.016	0.046	0.0
Cu	0.668	0.024	0.0
Cd	<0.005	<0.005	-
Pb	-	-	-
F	-	-	0.0
Al	-	-	-
P (total)	0.099	0.067	-
Salt (NaCl)	-	-	-
NO ₃ ⁻ (as N)	0.041	<0.005	-
Kjeldahl N	0.245	0.041	-
Sulfate	-	-	3.4
Hydrogen Sulfide	-	-	-
Alkalinity (as CaCO ₃)	2.9	0.0	-
Hardness (as CaCO ₃)	10.57	4.36	7.4
Acidity	-	-	-
Apparent Colour			
Turbidity	30	15	50
Chemical Oxygen Demand	0.46	0.61	-
Total Nitrogen	18	9.32	-
Total Organic Carbon			
Alkalinity (as HCO ₃ ⁻ and CO ₃ ²⁻)			3.8
Cl and NO ₃			

* Data from Natural Water Resources Inventory, prepared by Shawinigan Engineering

** Concentrations in mg/L except where noted.

The relationships between surface water and groundwater chemistry within the Garnish River Basin were assessed using the conductivity data from the Garnish River hydrometric station (Table 9) and bedrock wells near the community of Winterland (Table 8). The conductivity is a relative measure of the dissolved solids within the water. At Winterland, the conductivity of the groundwater varied from 184 to 275 $\mu\text{mhos/m}$ while the conductivity of the Garnish River varied from 22 to 145 $\mu\text{mhos/m}$ and averaged 49 $\mu\text{mhos/m}$. Assuming the average conductivity of the river water was the result of mixing of groundwater discharge (represented by the conductivity of the Winterland samples) with precipitation runoff, the dilution relationship compares favourably with the estimated quantity of baseflow obtained for the Garnish River drainage basin (see Table 5).

7.0 CONCLUSIONS

The evaluation of the groundwater resources within the Burin Peninsula study area is largely based upon information provided by commercial well drillers as recorded on the Department of Environment water well records. There are 128 water well records currently available for the area. This number is not considered to be representative of the total number of drilled wells within the area and it is known that there are many shallow dug wells for which no records exist. In many instances the data such as well yield provided on the available records is incomplete. It is to be hoped that improvements in the quality of the data provided by well drillers will occur as the overall familiarity with the data and its value increases.

The overburden and bedrock strata underlying the Burin Peninsula study area are generally capable of yielding low to moderate groundwater supplies. Wells completed within outwash sand and gravel deposits have the highest yield potential for overburden deposits in the order of 25 to 100 L/min. Glacial till deposits generally have a low well yield. The well yield of the bedrock underlying the study area tends to be low to moderate in the order of 10 to 50 L/min. These yields are in accord with the very low porosity of the metamorphosed or crystalline rock such as the volcanic strata and granitic plutons that underlie much of the area. The obtainable yields from these strata are considered adequate for domestic water supplies.

Rock strata considered to have moderate to high groundwater yield potentials are the unmetamorphosed Devonian Sedimentary strata of the northwest Fortune Bay area, and the St. Lawrence Granite in the southern half of the Burin Peninsula. The high well yields in the order of 68 to 545 L/min. obtained from the Devonian Strata may be related to zones of primary permeability within the coarse grained conglomerates. These strata are considered to have a potential to supply sufficient water to develop municipal or industrial wells.

The St. Lawrence Granite is well known for its high groundwater yields in both wells (568 L/min.) and underground mine workings (9464 L/min.). The high groundwater yields obtained from this granite are related to extensive fracturing within the rock. The layered felsic volcanics of the Grand Beach Complex located in the northwest side of the Burin Peninsula is considered to have a high potential for developing groundwater resources. This potential has not been extensively investigated to date.

Groundwater quality within the study area tends to be good, consisting of calcium, magnesium and bicarbonate water that is usually soft although some areas of hard groundwater were located near Lamaline. No strong correlation was noted between water quality and bedrock type. The groundwater locally contains elevated concentrations of iron and manganese, a situation commonly associated with extensive areas of barren bog such as occur on the Burin Peninsula. These constituents tend to affect the aesthetic quality of the water as they cause staining. Groundwater obtained from the St. Lawrence Granite, although of high volume, tends to

have elevated levels of radon gas and fluoride concentrations near or in excess of permissible levels. Apparently this situation is largely restricted to this body of rock.

The quality of surface water has been monitored at three locations throughout the study area. The water was found to be very soft with very low dissolved solids and no evidence of contamination. Surface water is used for municipal and industrial water supply in many communities within the study area.

Bacterial contamination is considered to be the primary potential threat to domestic well water sources within the study area. This threat increases as the population of communities that are dependent on wells increases or where domestic livestock are held. The threat of bacterial contamination in well water can be largely eliminated by the use of properly located and constructed wells. Such measures include locating wells away from potential contamination sources such as septic systems and the installation of properly seated well casings grouted into the bedrock surface and the use of sanitary well seals to prevent infiltration of surface water into the wells.

LIST OF REFERENCES

- Colman-Sadd, S.D. 1976. Geology of the St. Alban's Map Area, Newfoundland (1M/13) Report 76-4, St. John's, Newfoundland, 1976.
- Consumer Affairs and Environment, 1979. Water Well Data for Newfoundland 1950-1977, Water Resources Branch, Government of Newfoundland and Labrador, Vol. 1 and 2, 1979, 1010p.
- Dickson, W.L., 1983. Geology, Geochemistry and Mineral Potential of the Ackley Granite and Parts of the Northwest Brook and Eastern Meelpaeg Complexes, Southeast Newfoundland (Parts of Map Areas 1M/10, 11, 14, 15, 16, 2D/1, 2, 3, and 7) Report 83-6, St. John's, Newfoundland, 1983.
- Environment Canada, 1981. Canadian Climatic Normals 1951-1980. Temperature and Precipitation, Atlantic Provinces, Atmospheric Environment Service, Ottawa, Canada, 1981.
- Environment Canada, 1981. National Inventory of Municipal Waterworks and Wastewater Systems in Canada, 1981.
- Environment Canada, 1982. Water Quality Data, Newfoundland, 1965-1980, Inland Waters Directorate, Atlantic Region, Water Quality Branch, Ottawa, Canada, 1982.
- Environment Canada; 1984. Surface Water Data, Atlantic Provinces 1982, 1983, Inland Waters Directorate, Water Resources Branch, Water survey of Canada, Ottawa, Canada, 1984.
- Fracflow Consultants Incorporated, 1984. Hydrogeology of the Avalon Peninsula Area, Water Resources Report 2-6, Groundwater Series, Department of Environment, Water Resources Division, St. John's, Newfoundland in press.
- Freeze, R.A., and Cherry, J.A. 1979. Groundwater, Prentice Hall, New Jersey, United States, 604p.

LIST OF REFERENCES (continued)

- Golder Associates, 1983. Hydrogeology of the Humber Valley Area, Water Resources Report 2-5, Groundwater Series, Department of Environment, Water Resources Division, St. John's, Newfoundland, 1983.
- Health and Welfare Canada, 1978. Guidelines for Canadian Drinking Water Quality, Ministry of Supply and Services, Ottawa, Canada.
- Hydrology Consultants Limited, 1980. Hydrogeologic Study Notre Dame Bay Area, Newfoundland, Water Resources Report 2-2, Groundwater Services Government of Newfoundland and Labrador, Department of Consumer Affairs and Environment, Water Resources Branch, St. John's, Newfoundland.
- Lear, E., 1960. Report on Lories Peat Bog and Six Other Bog Areas in the Burin Peninsula, Department of Mines and Resources. Division of Mines, St. John's, Newfoundland, 1960.
- Nolan, F.L. and Associates Ltd., 1971. A Study of Groundwater and Seepage and Related Radiation in the St. Lawrence Area, Newfoundland, for Department of Mines, Agricultural and Resources, St. John's, Newfoundland, 1971.
- O'Brien, S.J., Taylor, S.W., Strong, P.G., and Wilton, D.H. 1978. Geology of the Marystown (1M/3) and St. Lawrence (2L/14) Map Areas, Newfoundland Report 77-8, St. John's Newfoundland, 1978.
- O'Brien, S.J., Taylor, S.W., 1983. Geology of the Baine Harbour (1M/7) and Point Enrage (1M/6) Map Areas, Southeastern Newfoundland Report 83-5, St. John's, Newfoundland, 1983.
- O'Brien, S.J., Nunn, G.A.G., Dickson, W.L., and Tuach, J., 1984. Geology of the Terrenceville (1M/10) and Gisborne Lake (1M/15) Map Areas, Southeast Newfoundland Report 84-4, St. John's, Newfoundland, 1984.
- Shawinigan Engineering Company Limited and James F. MacLaren Ltd., 1968. Water Resources Study of the Province of Newfoundland and Labrador for the Atlantic Development Board, Eight Volumes.

LIST OF REFERENCES (continued)

Twenhofel, W.H., and MacClintock, P., 1940. The surface of Newfoundland. Geological Society of America Bulletin, Volume 51, pages 1755-1929.

Vanderveer, D.G., 1977. Surficial and Glacial Geology, Gravel Resource Inventory, Burin Peninsula, Newfoundland. Newfoundland Department of Mines and Energy, Mineral Development Division, Open File Nfld. 958.

Williams, J. (compiler), 1978. Tectonic-Lithofacies Map of the Appalachian Orogen. Memorial University of Newfoundland, Map No. 1.

Surface Water Data, Atlantic Provinces, 1982. Inland Water Directorate, Water Resources Branch, Water Survey of Canada, Ottawa, Canada 1982.

Surface Water Data, Atlantic Provinces, 1982. Inland Water Directorate, Water Resources Branch, Water Survey of Canada, Ottawa, Canada 1983.

APPENDIX I

CENSUS DATA
BURIN PENINSULA STUDY AREA
NEWFOUNDLAND

INCORPORATED COMMUNITIES

BURIN PENINSULA AREA, NEWFOUNDLAND

NAME	TYPE	1951	1956	1961	1966	1971	1976	1981	% Change 1951-1981	% Change 1971-1981
BAINE HARBOUR	L.G.C.	141	135	136	133	194	204	208	47.5	7.2
BAY L'ARGENT	TOWN	416	418	431	502	453	474	483	16.1	6.6
BURIN	TOWN	796	1116	1116	1167	2586	2892	2904	264.8	12.3
BELLEFARM	TOWN	663	570	577	564	530	536	565	-14.8	6.6
CONNIE RIVER	L.I.D.	148	151	319	366	486	531	588	297.3	21.0
ENGLISH HARBOUR EAST	L.G.C.	214	215	228	245	217	278	316	47.7	45.6
FOX COVE-MORTIER	R.D.	330	373	338	353	445	469	469	42.1	5.4
FRENCHMAN'S COVE	L.G.C.	236	262	258	251	278	295	307	25.0	6.1
FORTUNE	TOWN	967	1194	1360	1703	2164	2406	2473	185.2	14.3
GARNISH	TOWN	591	545	500	519	618	678	761	28.8	23.1
GAULTOIS	TOWN	252	403	497	594	509	558	558	121.4	9.6
GRAND BANK	TOWN	2148	2430	2703	3143	3476	3802	3901	81.6	12.2
GRAND LE PIERRE	L.G.C.	139	186	236	257	294	368	381	174.1	29.6
HARBOUR BRETON	TOWN	903	989	1076	1442	2196	2317	2464	172.9	12.2
HERMITAGE	L.G.C.	396	395	417	398	637	830	863	117.9	35.5
JACQUES FONTAINE	L.G.C.	154	164	193	193	182	197	221	43.5	21.4
LEWIN'S COVE	L.G.C.	160	191	208	252	397	470	507	216.9	27.7
(LOON'S COVE)										
LITTLE BAY EAST	L.G.C.	-	-	-	-	-	213	202	-	-
LAWN	TOWN	531	634	716	875	1000	1025	999	88.1	-0.1
LANALINE	TOWN	590	548	530	644	553	543	548	-7.1	-0.9
L'AMÉE AU LOUP	L.G.C.	268	291	343	400	448	536	-	-	-
LORD'S COVE	L.G.C.	363	361	391	418	398	409	384	5.8	-3.5
MARYSTOWN	TOWN	1206	1460	1691	1894	4960	5915	6299	422.3	27.0
MILLTOWN-HEAD OF	R.D.	563	693	972	1079	1233	1325	1376	144.4	11.6
BAY D'ESPOIR	L.G.C.	122	166	180	211	223	217	213	91.0	4.5
MORRISVILLE	L.G.C.	164	234	289	343	405	381	424	158.5	4.7
PARKER'S COVE	L.G.C.	212	201	196	185	148	148	140	-34.0	-5.4
POINT AU GAUL	L.G.C.	256	292	316	347	334	372	427	66.8	27.0
POINT MAY	L.G.C.	290	234	263	242	237	242	244	-15.9	3.0
POOL'S COVE	L.G.C.	251	302	342	363	393	395	366	45.8	-6.8
PORT AU BRAS	L.G.C.	-	-	18	6	160	206	231	-	44.4
RED HARBOUR	L.G.C.	306	305	293	296	235	214	230	-24.8	-2.1
RENCONTRE EAST	L.G.C.	239	295	336	396	506	504	520	117.6	2.8
RUSHOON	L.G.C.	1079	1334	1547	1715	1941	2040	1968	82.4	-3.5
ST. ALBANS	TOWN	384	415	461	549	558	611	696	81.3	24.7
ST. BERNARD'S	L.G.C.	1056	1058	1103	1101	1099	1061	1048	-0.7	-4.6
ST. JACQUES-COOMB'S COVE	L.I.D.	1451	1837	2095	2130	2173	2258	2012	38.7	-7.4
ST. LAWRENCE	TOWN	424	521	616	662	700	764	796	87.7	13.7
TERRECEVILLE	TOWN	70	82	75	66	140	184	233	232.9	66.4
WINTERLAND	L.G.C.	18379*	20700*	23394*	26004*	33506*	36880	37333*	103.1%	11.4%
40									Growth	

* 38 COMMUNITIES INCLUDED
+ 39 COMMUNITIES INCLUDED

L.G.C. Local Government Community
L.I.D. Local Improvement District
R.D. Rural District

Data from Newfoundland Statistics Agency, 1982

UNINCORPORATED PLACES

BURIN PENINSULA AREA, NEWFOUNDLAND

<u>NAME</u>	<u>1966</u>	<u>1971</u>	<u>1976</u>	<u>1981</u>	<u>% Growth 1971 - 1981</u>
BEAU BOIS	58	61	68	88	44.2
BOAT HARBOUR	196	206	194	211	2.4
BROOKSIDE	115	86	80	83	-3.4
CORBIN	103	33	33	34	3.0
EPWORTH	232	242	222	243	0.4
GRAND BEACH	134	108	93	88	-18.5
HARBOUR MILLE	390	342	316	293	-14.3
JEAN DE BAIE	93	110	135	168	52.7
LITTLE HARBOUR EAST	60	57	46	51	-10.5
LITTLE ST. LAWRENCE	243	254	244	244	-3.9
MOLLIERS	4	5	12	-	-
PETIT FORTE	174	81	81	90	11.1
RAGGED POINT	119	116	124	-	-
ROCK HARBOUR	174	149	148	142	-4.7
ST. JOSEPH'S COVE	298	179	157	145	-19.0
ST. VERONICA'S	166	161	134	99	-38.5
SALMONIER	-	-	52	50	-
SOUTH EAST BIGHT	104	65	86	115	76.9
SPANISH ROOM	112	106	142	168	58.5
TAYLOR'S BAY	48	42	31	30	-28.6
BETWEEN PLACES	-	-	-	70	-
20	2823*	2403*	2398	2262	-5.9

*19 COMMUNITIES

APPENDIX II

WATER WELL RECORDS
BURIN PENINSULA STUDY AREA
NEWFOUNDLAND

BURGEO-BAY D'ESPOIR

COMMUNITY	WELL NO. AND OWNER	DATE MO/YR	DEPTH FT	WATER FOUND FT	CASING		YIELD gpm	KIND OF WATER	WATER USE	HYDROSTRATIGRAPHIC UNIT
					LENGTH FT	DIAMETER IN.				
Conne River	1 Native Enter- prises	06/77	325	100 & 150 310	22	6	2			UNIT 3
"	2 Native Enter- prises	06/77	240	70 & 150	90	6	3			UNIT 3
"	3 Conne River Indian Band Council	10/78	105	30 & 85	40	6	9		DO	UNIT 3 0-20' overburden 20-105' bedrock
"	4 Conne River Indian Band Council	10/78		50 & 250	14	6	1.5		DO	UNIT 3 0-10' overburden 10-250' bedrock
"	5 Conne River Indian Band Council	May 4/81	300	200	45	6	1		MU	UNIT 3 0-25' overburden 25-300' bedrock

BURGEO-BAY D'ESPOIR

COMMUNITY	WELL NO. AND OWNER	DATE MO/YR	DEPTH FT	WATER FOUND FT	CASING		YIELD gpm	KIND OF WATER	WATER USE	HYDROSTRATIGRAPHIC UNIT
					LENGTH FT	DIAMETER IN.				
Conne River	6 Conne River Indian Band Council	May 5/81	200	150	40	6	0.5		MU	UNIT 3 0-20' overburden 20-200' bedrock
"	7 Conne River Indian Band Council	May 7/81	200	180	22	6	0.5		MU	UNIT 3 0-5' overburden 5-200' bedrock
"	8 Conne River Indian Band Council	May 8/81	200	150	90	6	1		MU	UNIT 3 0-40' overburden 40-200' bedrock
"	9 Conne River Native Enter- prises	Aug. 12/81	200	140 & 180	21	6	6		MU	UNIT 3 0-6' overburden 6-200' bedrock

BURGEON-BAY D'ESPOIR

COMMUNITY	WELL NO. AND OWNER	DATE MO/YR	DEPTH FT	WATER FOUND FT	CASING		YIELD gpm	KIND OF WATER	WATER USE	HYDROSTRATIGRAPHIC UNIT
					LENGTH FT	DIAMETER IN.				
Conne River	10 Conne River Native Enter- prises	Dec. 7/81	40		9	6	0			UNIT 3 0-40' bedrock
Hermitage	1 Bay D'Espoir Inte- grated School Board		250	25 & 100	8	6	0.5			UNIT 5 0-4' overburden 4-250' bedrock
Milltown	1 Christ Church	Jan. 18/82	160	101	35	6	1			UNIT 3 0-30' overburden 30-160' bedrock
St. Albans	1	05/71	30			6		FR	DO	UNIT 3 0-25' overburden 25-30' bedrock

FORTUNE - HERMITAGE

COMMUNITY	WELL NO. AND OWNER	DATE MO/YR	DEPTH FT	WATER FOUND FT	CASING		YIELD gpm	KIND OF WATER	WATER USE	HYDROSTRATIGRAPHIC UNIT
					LENGTH FT	DIAMETER IN.				
Bay L'Argent	1 R.A. Edwards	09/77	105	90	16	6	5		DO	UNIT 2 0-14' overburden 14-105' bedrock
	2 George Lawrence	09/77	123	105	12	6	8		DO	UNIT 2 0-10' overburden 10-123' bedrock
	3 Norman Pope	June 06/84	45		22	6	1		DO	UNIT 2 0-22' overburden 22-45' bedrock
Boxey	1 Garfield Straw- bridge	02/79	45	25	19	6	10		DO	UNIT 4 0-12' overburden 12-45' bedrock
	2 Eugene Tobin	02/79	85	60	11	6	1		DO	UNIT 4 0-6' overburden 6-85' granite
	3 Gordon Petie	April 23/84	115		14	6	1		DO	UNIT 4 0-14' overburden 14-115' bedrock
	4 Allen Spencer	April 24/84	65		8	6	3		DO	UNIT 4 0-8' overburden 8-65' bedrock

FORTUNE - HERMITAGE

COMMUNITY	WELL NO. AND OWNER	DATE MO/YR	DEPTH FT	WATER FOUND FT	CASING		YIELD gpm	KIND OF WATER	WATER USE	HYDROSTRATIGRAPHIC UNIT
					LENGTH FT	DIAMETER IN.				
English Hr. East	1 Guy Hackett	June /84	120		11	6	0.5		DO	UNIT 1 0-120' bedrock
English Hr. West	1 English Harbour School Board	Nov. 21/77	60	25 & 42	50	6	12		DO	UNIT 4
"	2 William Taylor Laura Thornhill	Feb. 22/79	160	105	13	6	1		DO	UNIT 4
"	3 William Skinner	Feb. 21/79	125	85 & 105	8	6	1		DO	UNIT 4
"	4 Pamela Lawrence & Francis Drake	Feb. 22/79	65	58	8	6	5		DO	UNIT 4
"	5 William Evans	Feb. 20/79	65	40	9	6	3.5		DO	UNIT 4

FORTUNE - HERMITAGE

COMMUNITY	WELL NO. AND OWNER	DATE MO/YR	DEPTH FT	WATER FOUND FT	CASING		YIELD gpm	KIND OF WATER	WATER USE	HYDROSTRATIGRAPHIC UNIT
					LENGTH FT	DIAMETER IN.				
English Hr. West	6 John Bullen	Feb. 21/79	65	45	7	6	1		DO	UNIT 4
"	7 Inte- grated School Board	10/77	140	120	16		20		School	UNIT 4
"	8 Gordon Hunt	11/79	65	40	21		6		DO	UNIT 4
"	9 Roland Oakley	11/79	45	30	16		2.5		DO	UNIT 4
"	10 Dean Forest	11/79	45	20	7		20		DO	UNIT 4
"	11 English Hr. West School Board	11/77	170	20	16		120		School	UNIT 4
"	12 Enos Hepditch	02/79		40	11		1.5		DO	UNIT 4

FORTUNE - HERMITAGE

COMMUNITY	WELL NO. AND OWNER	DATE MO/YR	DEPTH FT	WATER FOUND FT	CASING		YIELD gpm	KIND OF WATER	WATER USE	HYDROSTRATIGRAPHIC UNIT
					LENGTH FT	DIAMETER IN.				
English Hr. West	13 Harold Hardimen	02/79	85	60	8		4		DO	UNIT 4
"	14 William Skinner	02/79					1		DO	UNIT 4
"	15 Enos Hepditch (Well 2)	11/79	65	40	21		6		DO	UNIT 4
"	16 Bruce Vallis	Feb. 12/81	140	60 & 133	14		0.5			UNIT 4
"	17 H. Keeping	Jan. 12/81	60	30	14		5			UNIT 4
"	18 William Bishop	Nov. 30/81	100	64	13		1			UNIT 4
"	19 Orval Miles	Nov. 27/81	60	40	13		15			UNIT 4
"	20 Harry Petite	April 16/84	65		26		0.5			UNIT 4

FORTUNE - HERMITAGE

COMMUNITY	WELL NO. AND OWNER	DATE MO/YR	DEPTH FT	WATER FOUND FT	CASING		YIELD gpm	KIND OF WATER	WATER USE	HYDROSTRATIGRAPHIC UNIT
					LENGTH FT	DIAMETER IN.				
English Hr. West	21 J. Blagdon	April 17/84	185		7	6	0.5		DO	UNIT 4
"	22 Warren Keepings	April 17/84	65		20	6	1		DO	UNIT 4
"	23 Mary Bungay	April 16/84	85		8	6	0.5		DO	UNIT 4
Frenchmans Cove	1 Bayside Sea Food	Nov. 12/83	90		88	6	10			UNIT 2
Garnish	1 Ron Cribb	May 21/84	200		21	6	1.5		DO	UNIT 2
"	2 Wilbert Legge	Nov. 5/82	240	90	15	6	1.5		DO	UNIT 2
"	3 Keith Bolt	/84	45		15	6	5		DO	UNIT 2
"	4 Tom Coady	June 1/84	85		14	6	2		DO	UNIT 2

FORTUNE - HERMITAGE

COMMUNITY	WELL NO. AND OWNER	DATE MO/YR	DEPTH FT	WATER FOUND FT	CASING		YIELD gpm	KIND OF WATER	WATER USE	HYDROSTRATIGRAPHIC UNIT
					LENGTH FT	DIAMETER IN.				
Garnish	5 John Coady	/84	65		15	6	2		DO	UNIT 2
Jacques Fontaine	1 Burin Penin- sula School Board	03/75	98		95	6	15			UNIT 2
"	2 Harold Banfield	09/77	70		63	6	15		DO	UNIT 2
"	3 Joe Hynes	Sept. 21/79	71		35					UNIT 2
Little Hr. East	1 Cecil Scott	May 24/84	85		22	6	0.5			UNIT 2
Pool's Cove	1 Calvin Andrews	02/79	65	40	8	6	7.5		DO	UNIT 4

FORTUNE - HERMITAGE

COMMUNITY	WELL NO. AND OWNER	DATE MO/YR	DEPTH FT	WATER FOUND FT	CASING		YIELD gpm	KIND OF WATER	WATER USE	HYDROSTRATIGRAPHIC UNIT
					LENGTH FT	DIAMETER IN.				
Pool's Cove	2 Allen Bambury	April 24/84	85		8	6	0.5		DO	UNIT 4
St. Bernards	1 Whittle	Nov. 15/78	230	66	14.5	6	0.5		DO	UNIT 2
St. Jacques	1 Alex Hickey	10/77	55	50	8	6	6		DO	UNIT 5
"	2 Sam Lawrence	11/77	100	40	8	6	3		DO	UNIT 5
"	3 J. Skinner	Dec. 3/84	50	40	12	6	30		DO	UNIT 5
Terrenceville	1 Don Cox	Nov. 17/78	250	200	76.5	6	.75		DO	UNIT 4
Wreck Cove	1 Cyril Straw- bridge	11/77	105	25		6	4		DO	

GRAND BANK

COMMUNITY	WELL NO. AND OWNER	DATE MO/YR	DEPTH FT	WATER FOUND FT	CASING		YIELD gpm	KIND OF WATER	WATER USE	HYDROSTRATIGRAPHIC UNIT
					LENGTH FT	DIAMETER IN.				
Lamaline	1 Town	06/76	200			6	0.5		IN	UNIT 1 0-20' overburden 20-200' bedrock
"	2 Bona- vista Cold Storage	11/66	259			6	7		IN	UNIT 1
"	3 Town	06/76	300			6	0.5		IN	UNIT 1 0-14' overburden 14-300' bedrock
"	4 R.C. School Board	06/76	380			6	3			UNIT 1 0-12' overburden 12-300' bedrock
"	5 Light House	11/78	145		13.5		<0.5			UNIT 1
"	6 Lamaline School	10/77	500	125	12		2			UNIT 1
Lawn	1 Bona- vista Cold Storage	03/66	190			8	9	Salt at high tide		UNIT 1 0-160' overburden 160-190' bedrock

GRAND BANK

COMMUNITY	WELL NO. AND OWNER	DATE MO/YR	DEPTH FT	WATER FOUND FT	CASING		YIELD gpm	KIND OF WATER	WATER USE	HYDROSTRATIGRAPHIC UNIT
					LENGTH FT	DIAMETER IN.				
Fortune	1 Sam Lake	June 05/84	120		45	6	0.5		DO	UNIT 2
St. Lawrence	1 Town	/52	326			8				UNIT 6
"	2 D.O.T. Decca Station	/64	120			6	3			UNIT 6 0-20' overburden 20-120' bedrock
"	3 D.O.T. Decca Station	/65	125			6				UNIT 6 0-20' overburden 20-125' bedrock
"	4 Nfld. Telephone	Nov. 6/78	98	90	26.5	6	1		IN	UNIT 6
"	5 Fabian Alward	July 10/82	80	72	13	6	3		DO	UNIT 6
Little St. Lawrence	1 Ken Moores	07/80	105	70 90	16	6	3		DO	UNIT 2
"	2 Wilson Hickman	May 16/84	140		23	6	2		DO	UNIT 2

BURIN - PLACENTIA WEST

COMMUNITY	WELL NO. AND OWNER	DATE MO/YR	DEPTH FT	WATER FOUND FT	CASING		YIELD gpm	KIND OF WATER	WATER USE	HYDROSTRATIGRAPHIC UNIT
					LENGTH FT	DIAMETER IN.				
Beau Bois	1 John Kelly	05/80	360		22					UNIT 5
Burin	1 Vocat- ional School	09/62	500		11	6	3			UNIT 1
"	2 Fisheries Products Limited	09/69	220		11		6			UNIT 1
Collins Cove	1 U.C. Minister	07/75	200 to 300		15		0.5			UNIT 1
Epworth	1 Carl Bundgress	May 23/84	40		15	6			DO	UNIT 5
Kirbys Cove	1 Eldon Foote	07/75	250		13		0.5			UNIT 1

BURIN - PLACENTIA WEST

COMMUNITY	WELL NO. AND OWNER	DATE MO/YR	DEPTH FT	WATER FOUND FT	CASING		YIELD gpm	KIND OF WATER	WATER USE	HYDROSTRATIGRAPHIC UNIT
					LENGTH FT	DIAMETER IN.				
Lewin's Cove	1 Charles Matthews	11/79	85	20 75	14	6	3		DO	UNIT 1
"	2 Charles Matthews	Aug. /82	60	40	9	6	4		DO	UNIT 1
"	3 Richard Banfield	May 23/84	185		11	6	0.5		DO	UNIT 1
Little Bay East	1 Thomas Pardy	07/80	200	150	43	6	0.5		DO	UNIT 2
Little Bay	1 Tom Coady Robert Wburner	09/78		45	9	6	1		DO	UNIT 2
"	2 Kile Fop	02/82	220	120	10	6	1		DO	UNIT 2
"	3 Marg Kilgore	/82	160	150	160	6	3		DO	UNIT 2

BURIN - PLACENTIA WEST

COMMUNITY	WELL NO. AND OWNER	DATE MO/YR	DEPTH FT	WATER FOUND FT	CASING		YIELD gpm	KIND OF WATER	WATER USE	HYDROSTRATIGRAPHIC UNIT
					LENGTH FT	DIAMETER IN.				
Marystown	1 D.M.A.H.	09/66	230			6	20-30	FR	MU	UNIT 1 0-20' overburden 20-230' bedrock
"	2 T.F. Murley	09/62	110		3	6	3	FR	DO	UNIT 1 0-15' overburden 15-110' bedrock
"	3 Gorman Butler Assoc.	10/66	110			6		FR	CO	UNIT 1 0-100' overburden 100-140' bedrock
"	4 Marystown Parish	/66	140					FR	MU	UNIT 1 0-20' overburden 20-230' bedrock
"	5 Lundrigan Limited - Trailer Park	04/66	230			8	16	FR	CO	UNIT 1 0-20' overburden 20-230' bedrock
"	6 Lundrigan Const. Camp	04/66	190			8	6	FR	CO	UNIT 1 0-90' overburden 90-212' bedrock
"	7 Dept. of Education	/60	212					FR	MU	

BURIN - PLACENTIA WEST

COMMUNITY	WELL NO. AND OWNER	DATE MO/YR	DEPTH FT	WATER FOUND FT	CASING		YIELD gpm	KIND OF WATER	WATER USE	HYDROSTRATIGRAPHIC UNIT
					LENGTH FT	DIAMETER IN.				
Marystown	8 Ray Kavanagh	11/78	360		87	6	12		DO	UNIT 1
"	9 Thomas Hynes	09/78	145		8	6	0.5		DO	UNIT 1
"	10 Issac Fitzpatrick	04/78	85	45	18	6	6		DO	UNIT 1
"	11 John Kelly	May 06/80	360		22		0			
"	12 Bill Murley Bill Wiscombe	May 31/84	85		22	6	0.5		DO	UNIT 1
" (Creston South)	13 Dennis Rogers	July 07/82	40	36	19	6				UNIT 1
Parker's Cove	1 Joe Haynes	May 15/84	85		22	6	0.5			UNIT 1

BURIN - PLACENTIA WEST

COMMUNITY	WELL NO. AND OWNER	DATE MO/YR	DEPTH FT	WATER FOUND FT	CASING		YIELD gpm	KIND OF WATER	WATER USE	HYDROSTRATIGRAPHIC UNIT
					LENGTH FT	DIAMETER IN.				
Parker's Cove	2 Doug Murphy	May /84	14		14	6				UNIT 1
"	3 Cecil Murphy	May /84	165		22	6	0.5			UNIT 1
Red Harbour	1 D.M.A.H.	02/71	100		9		1.6	FR	MU	UNIT 1
"	2 A. Smith D.M.A.H.	02/71	100		7		15	FR	MU	UNIT 1
"	3 D.M.A.H.	02/71	50		5		1.5	FR	MU	UNIT 1
"	4 D.M.A.H.		50		19		NIL	FR	MU	UNIT 1
"	5 Community of Red Harbour	04/78	100	25 65	5	6	3			
Rock Harbour	1 D.M.A.H.	12/71	78			Bx 2 7/8	3	FR Chem. Sats.	MU	UNIT 2 0-78' bedrock

BURIN - PLACENTIA WEST

COMMUNITY	WELL NO. AND OWNER	DATE MO/YR	DEPTH FT	WATER FOUND FT	CASING		YIELD gpm	KIND OF WATER	WATER USE	HYDROSTRATIGRAPHIC UNIT
					LENGTH FT	DIAMETER IN.				
Salmonier	1 Andrew Daley	07/80	45	35	10		2		DO	UNIT 2
"	2 Frank McCrane	02/78	300	130	31		0.5		DO	UNIT 2
Salt Pond	1 Burin District Vocat- ional School	/64	280			10				UNIT 2 0-160' overburden 160-280' bedrock
"	2 Burin District Vocat- ional School	/64	340			10				UNIT 2 0-140' overburden 140-340' bedrock
"	3 Burin District Vocat- ional School	04/69	100 Deep- ened		25.5					UNIT 2

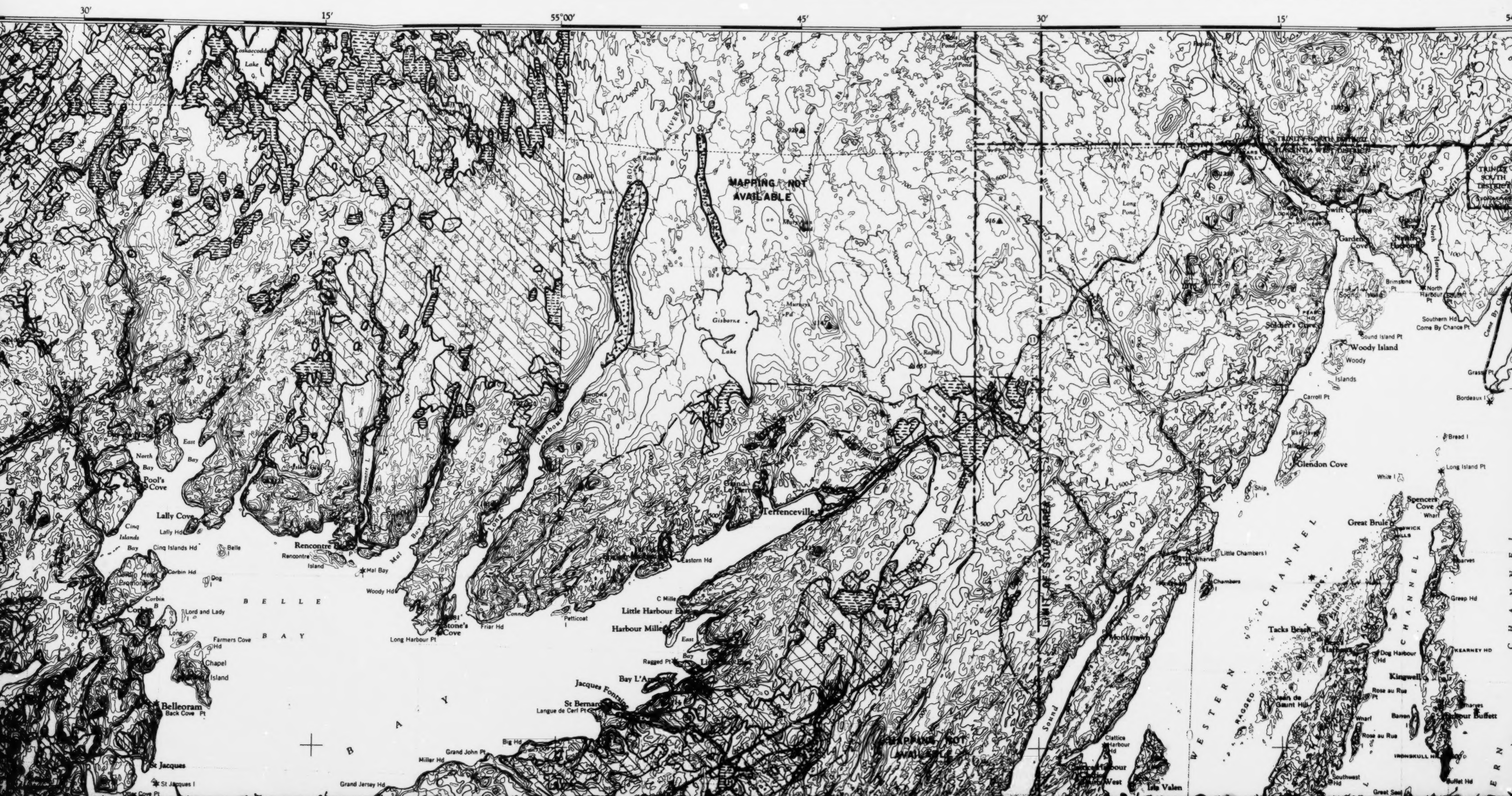
BURIN - PLACENTIA WEST

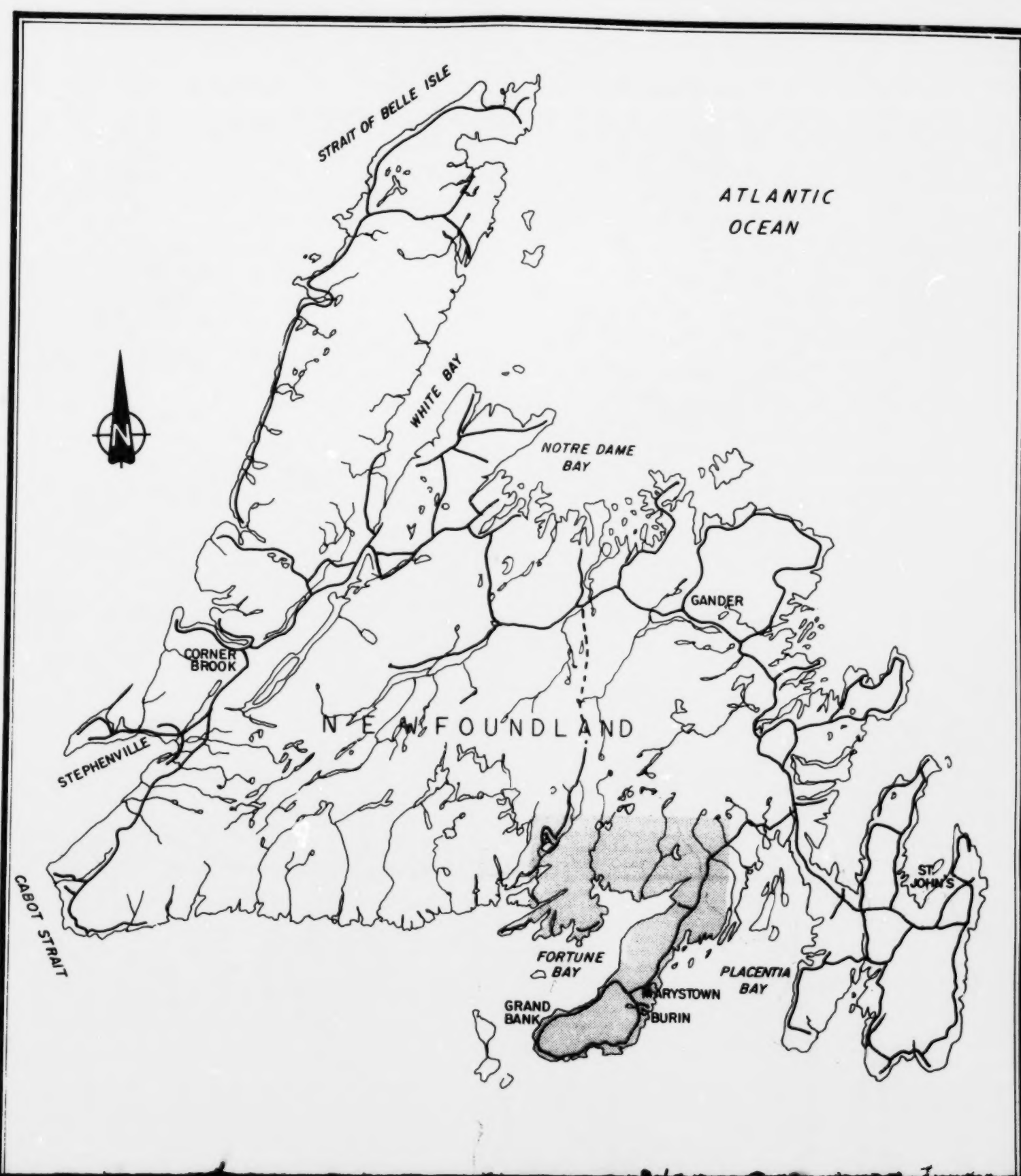
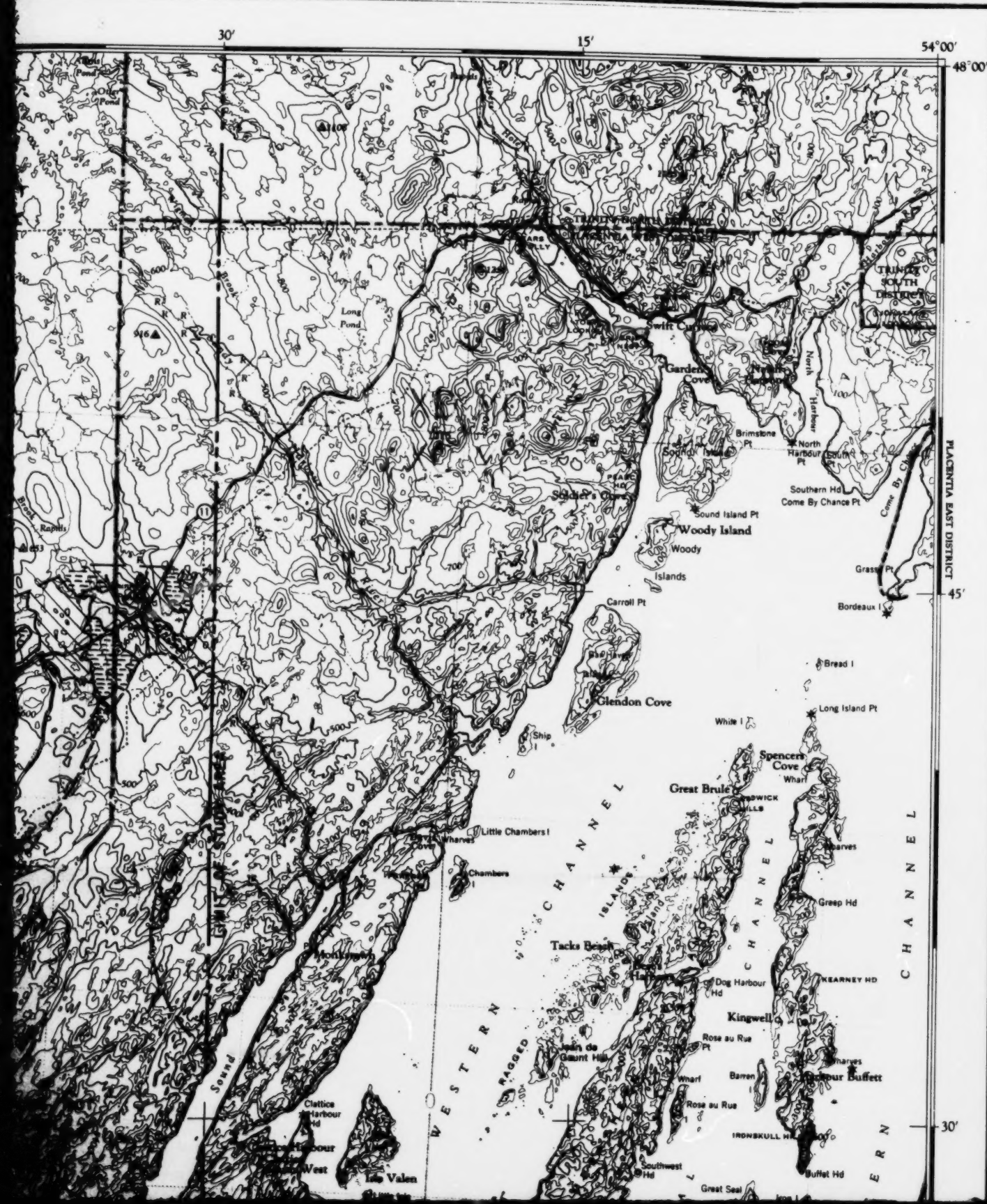
COMMUNITY	WELL NO. AND OWNER	DATE MO/YR	DEPTH FT	WATER FOUND FT	CASING		YIELD gpm	KIND OF WATER	WATER USE	HYDROSTRATIGRAPHIC UNIT
					LENGTH FT	DIAMETER IN.				
Tides Brook	1 W. J. Dober	07/80	150	125 140	22	6	1		DO	UNIT 1
	2 Mrs. Morley Hollett	07/80	200	195	62	6	1		DO	UNIT 1
	3 Roland Augustus	07/80	190	180	61	6	3		DO	UNIT 1
Winterland	1 Town Council	07/77	250	88 230 & 250	18	6	7.5		MU	UNIT 6 0-13' overburden 13-250' bedrock
	2 Town Council	07/75	375		15		0.5			UNIT 6
	3 Town Council	07/75	100		24		12			UNIT 6
	4 Fire Hall	07/75	150		18		4			UNIT 6

BURIN - PLACENTIA WEST

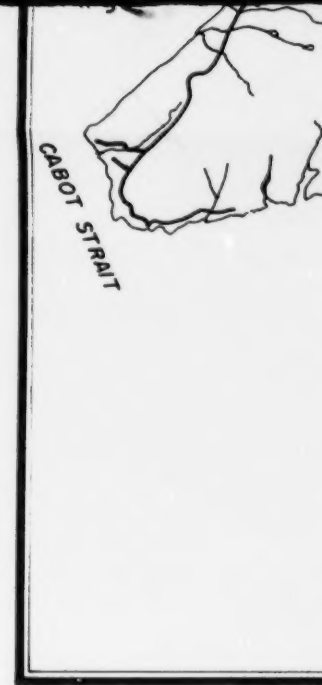
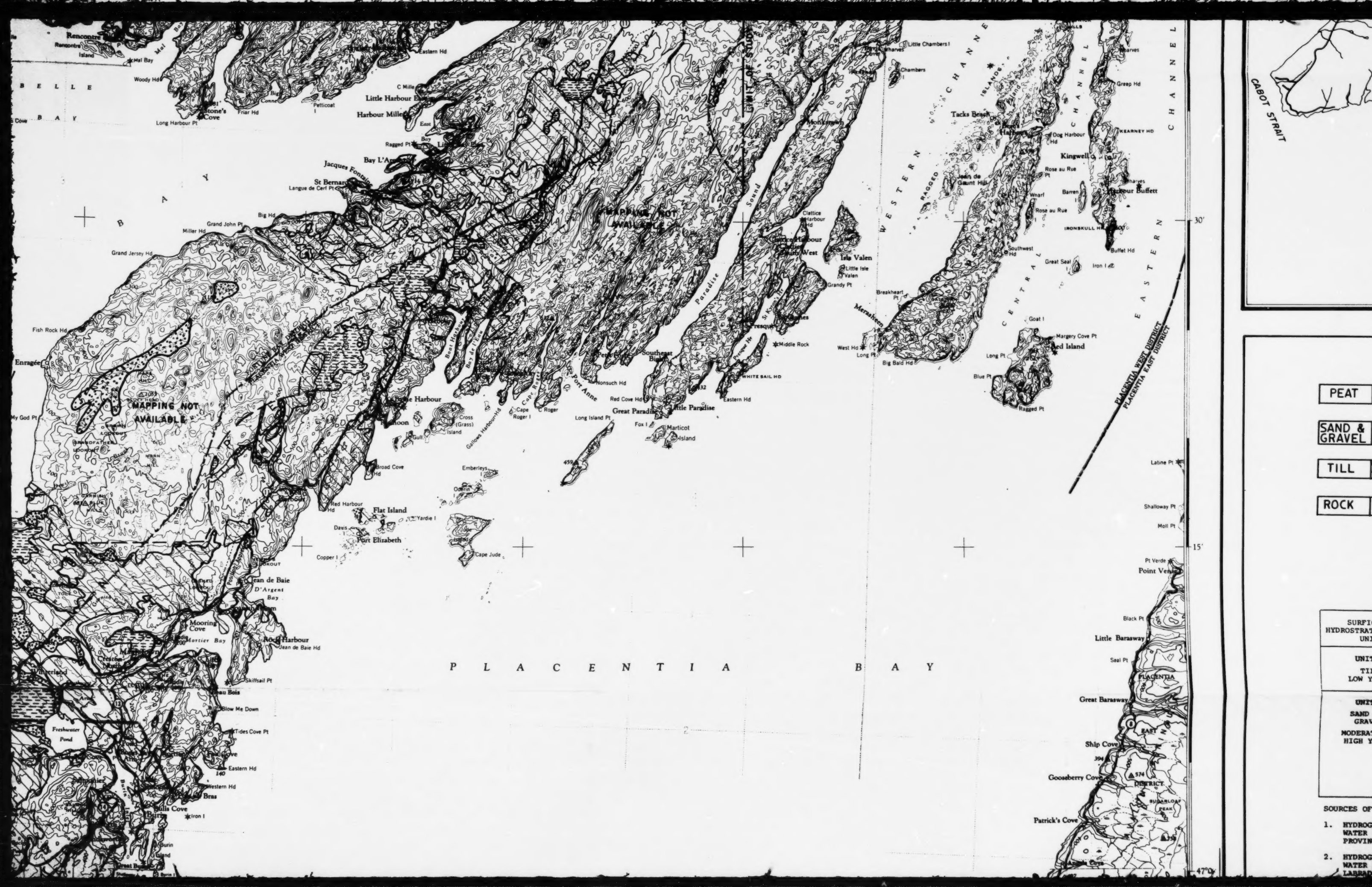
COMMUNITY	WELL NO. AND OWNER	DATE MO/YR	DEPTH FT	WATER FOUND FT	CASING		YIELD gpm	KIND OF WATER	WATER USE	HYDROSTRATIGRAPHIC UNIT
					LENGTH FT	DIAMETER IN.				
Winterland	5 Doug Lockiettt	Nov. 08/78	170	132 155 161	29	6	8			UNIT 6
"	6 Mr. Ron Hickey	Oct. /80	65	30 60	22	6	30		DO	UNIT 6
"	7 Lester Shave	June 4/84	85		17	6	2	FR	DO	UNIT 6
"	8 Cecil White	07/82	130	90	13	6	1		DO	UNIT 6







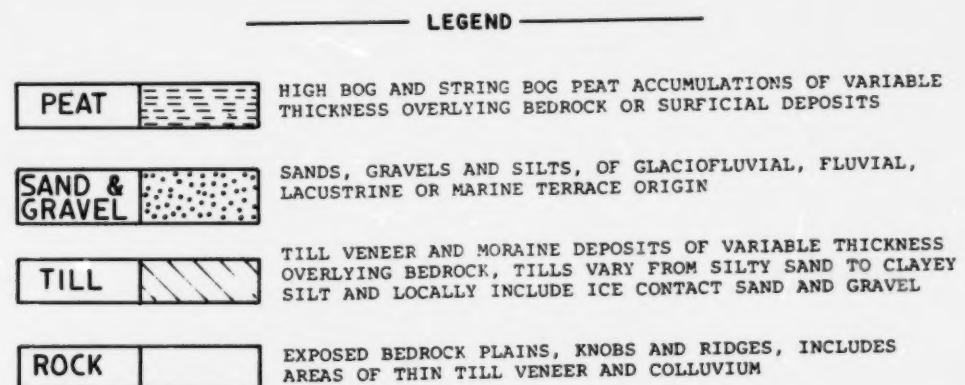
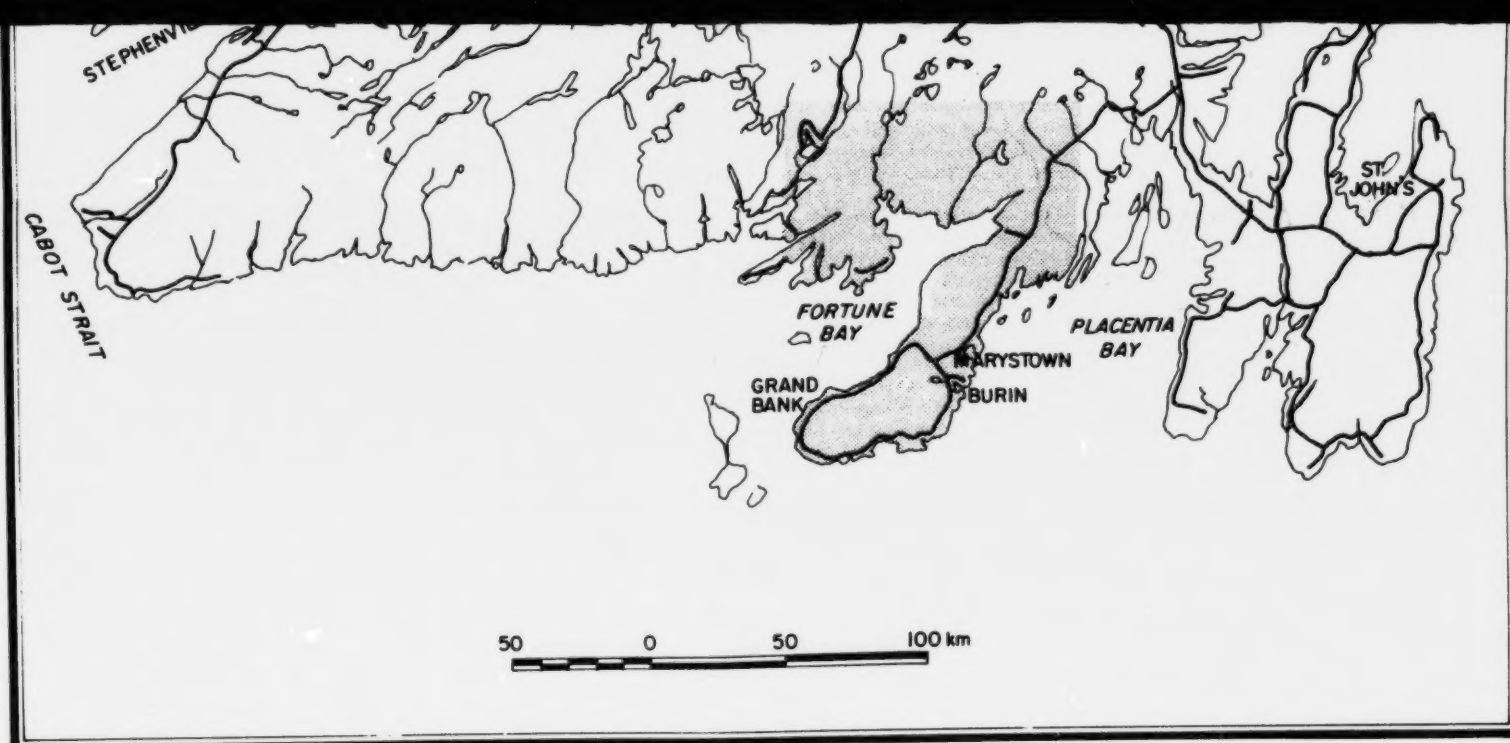




- PEAT
- SAND & GRAVEL
- TILL
- ROCK

- SURFACE HYDROGRAPHIC UNIT
- UNIT
- TILL
- LOW Y
- UNIT
- SAND
- GRAVEL
- MODERATE
- HIGH Y

- SOURCES OF
1. HYDROGRAPHIC WATER PROVIN
 2. HYDROGRAPHIC WATER LABRADOR



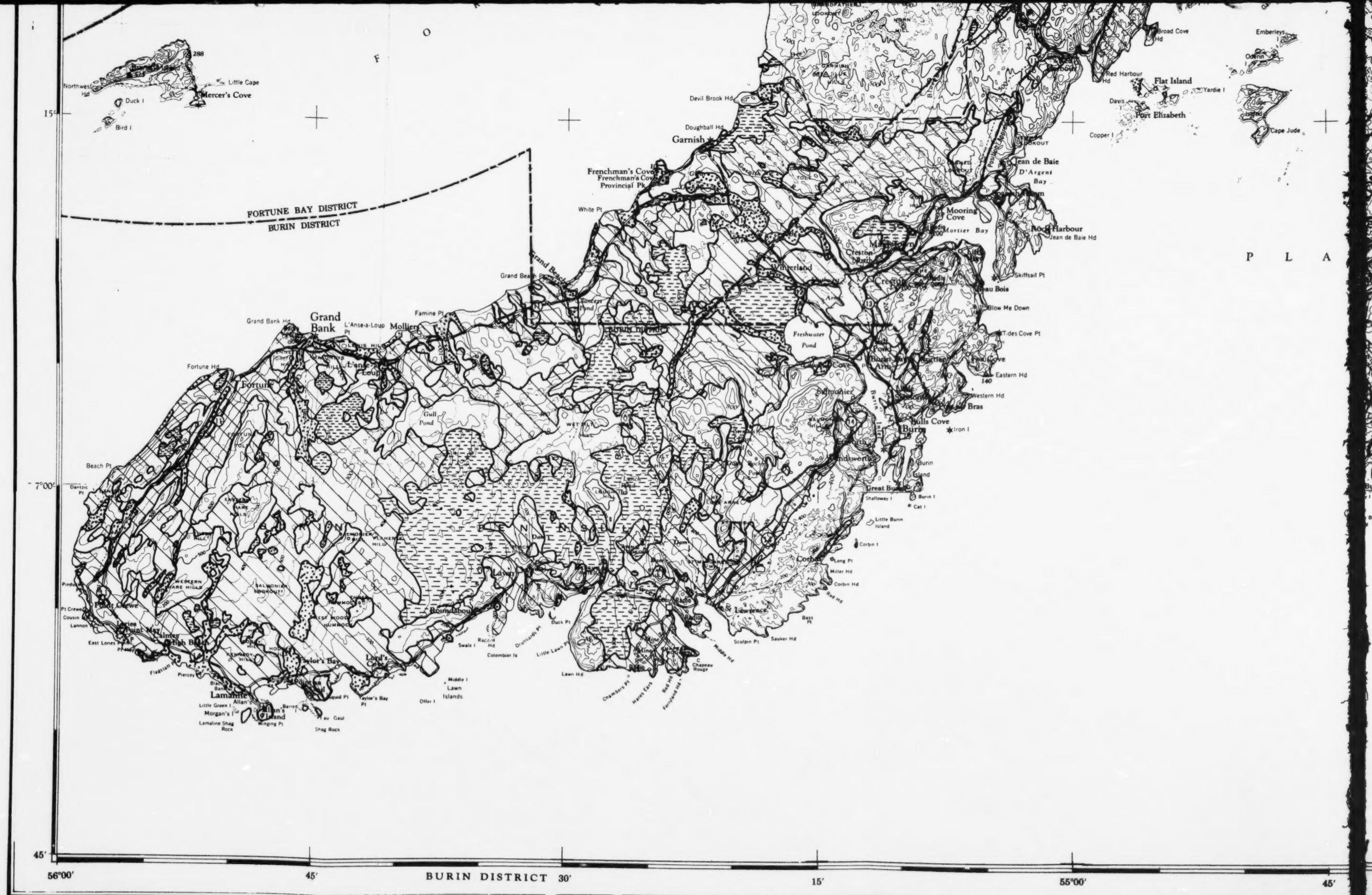
D.G. VANDERVEER, NEWFOUNDLAND DEPARTMENT OF MINES AND ENERGY, SURFICIAL GEOLOGY, 1:50000 MAP SHEETS, NFLD.

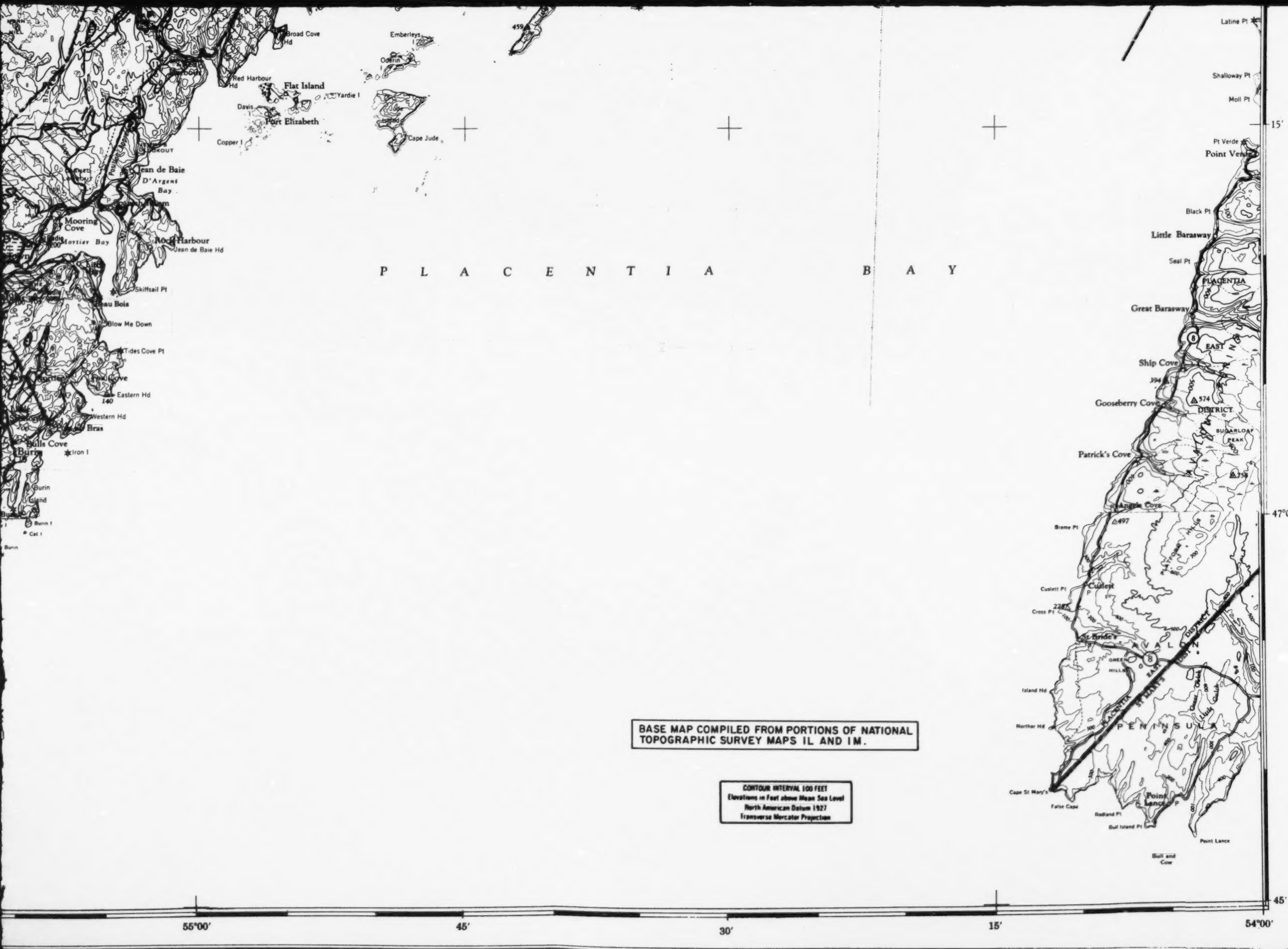
**SURFICIAL DEPOSIT HYDROSTRATIGRAPHIC UNITS
BURIN PENINSULA AREA, NEWFOUNDLAND**

SURFICIAL HYDROSTRATIGRAPHIC UNIT	WELL YIELD, lpm (gpm)			WELL DEPTH, m (feet)			DATA SOURCE
	RANGE	MEAN	MEDIAN	RANGE	MEAN	MEDIAN	
UNIT A TILL LOW YIELD	0-45 (0-10)	9 (2)		5-46 (15-150)			1
UNIT B SAND AND GRAVEL MODERATE TO HIGH YIELD	55-270 (12-60)	25 (5.4)	23 (5)	8-27 (25-90)	14 (46)		1
	4-340 (1-70)	100 (22)	45 (10)	10-15 (32-50)	13.1 (43)	14 (45)	2
	5.7-182 (1.25-40.0)	40.6 (8.9)		8.5-65.5 (28-215)	20.9 (68.7)		3

SOURCES OF DATA:

1. HYDROGEOLOGICAL STUDY NOTRE DAME BAY AREA, NFLD. WATER RESOURCES REPORT 2-1, DEPT. OF CONSUMER AFFAIRS AND ENVIRONMENT, PROVINCE OF NEWFOUNDLAND





TILL VENEER AND OVERLYING BEDROCK SILT AND LOCAL

ROCK EXPOSED BEDROCK AREAS OF THIN

D.G. VANDERVEER, NEWFOUNDLAND SURFICIAL GEOLOGY, 1:50000

SURFICIAL DEPOSITS BURIN PENINSULA

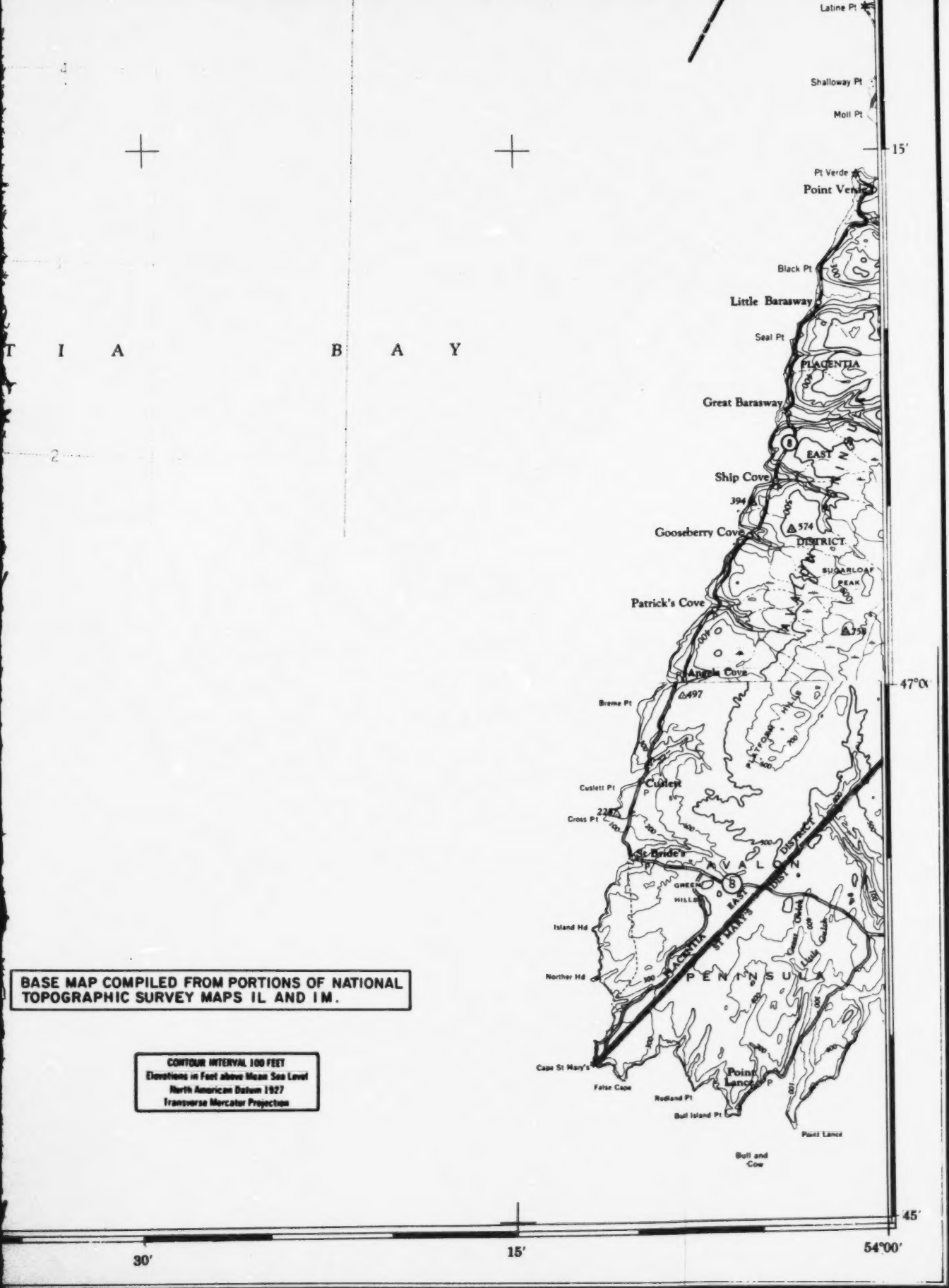
SURFICIAL HYDROSTRATIGRAPHIC UNIT	WELL YIELD, GPM	
	RANGE	MEAN
UNIT A TILL LOW YIELD	0-45 (0-10)	10
UNIT B SAND AND GRAVEL MODERATE TO HIGH YIELD	55-270 (12-60)	120 (5.4)
	4-340 (1-70)	100 (2.2)
	5.7-182 (1.25-40.0)	40.0 (8.9)

- SOURCES OF DATA:
1. HYDROGEOLOGICAL STUDY NOTRE DAME BAY WATER RESOURCES REPORT 2-1, DEPT. OF MINES AND TECHNICAL SERVICES, PROVINCE OF NEWFOUNDLAND
 2. HYDROGEOLOGY OF THE HUMBER VALLEY WATER RESOURCES REPORT 2-5, GROUNDWATER DIVISION, LABRADOR DEPARTMENT OF ENVIRONMENT
 3. HYDROGEOLOGY OF THE AVALON PENINSULA NEWFOUNDLAND AND LABRADOR DEPARTMENT OF MINES AND TECHNICAL SERVICES

DEPARTMENT OF MINES AND TECHNICAL SERVICES GOVERNMENT OF NEWFOUNDLAND

SURFICIAL HYDROSTRATIGRAPHY BURIN PENINSULA





BASE MAP COMPILED FROM PORTIONS OF NATIONAL TOPOGRAPHIC SURVEY MAPS 1L AND 1M.

CONTOUR INTERVAL 100 FEET
Elevations in Feet above Mean Sea Level
North American Datum 1927
Transverse Mercator Projection

TILL

OVERLYING BEDROCK, TILLS VARY FROM SILTY SAND TO CLAYEY SILT AND LOCALLY INCLUDE ICE CONTACT SAND AND GRAVEL

ROCK

EXPOSED BEDROCK PLAINS, KNOBS AND RIDGES, INCLUDES AREAS OF THIN TILL VENEER AND COLLUVIUM

D.G. VANDERVEER, NEWFOUNDLAND DEPARTMENT OF MINES AND ENERGY,
SURFICIAL GEOLOGY, 1:50000 MAP SHEETS, NFLD.

SURFICIAL DEPOSIT HYDROSTRATIGRAPHIC UNITS
BURIN PENINSULA AREA, NEWFOUNDLAND

SURFICIAL HYDROSTRATIGRAPHIC UNIT	WELL YIELD, lpm (gpm)			WELL DEPTH, m (feet)			DATA SOURCE
	RANGE	MEAN	MEDIAN	RANGE	MEAN	MEDIAN	
UNIT A TILL LOW YIELD	0-45 (0-10)	9 (2)		5-46 (15-150)			1
UNIT B SAND AND GRAVEL MODERATE TO HIGH YIELD	55-270 (12-60)	25 (5.4)	23 (5)	8-27 (25-90)	14 (46)		1
	4-340 (1-70)	100 (22)	45 (10)	10-15 (32-50)	13.1 (43)	14 (45)	2
	5.7-182 (1.25-40.0)	40.6 (8.9)		8.5-65.5 (28-215)	20.9 (68.7)		3

SOURCES OF DATA:

1. HYDROGEOLOGICAL STUDY NOTRE DAME BAY AREA, NFLD.
WATER RESOURCES REPORT 2-1, DEPT. OF CONSUMER AFFAIRS AND ENVIRONMENT,
PROVINCE OF NEWFOUNDLAND
2. HYDROGEOLOGY OF THE HUMBER VALLEY AREA.
WATER RESOURCES REPORT 2-5, GROUNDWATER SERIES, NEWFOUNDLAND AND
LABRADOR DEPARTMENT OF ENVIRONMENT.
3. HYDROGEOLOGY OF THE AVALON PENINSULA AREA.
NEWFOUNDLAND AND LABRADOR DEPARTMENT OF ENVIRONMENT, IN PRESS.



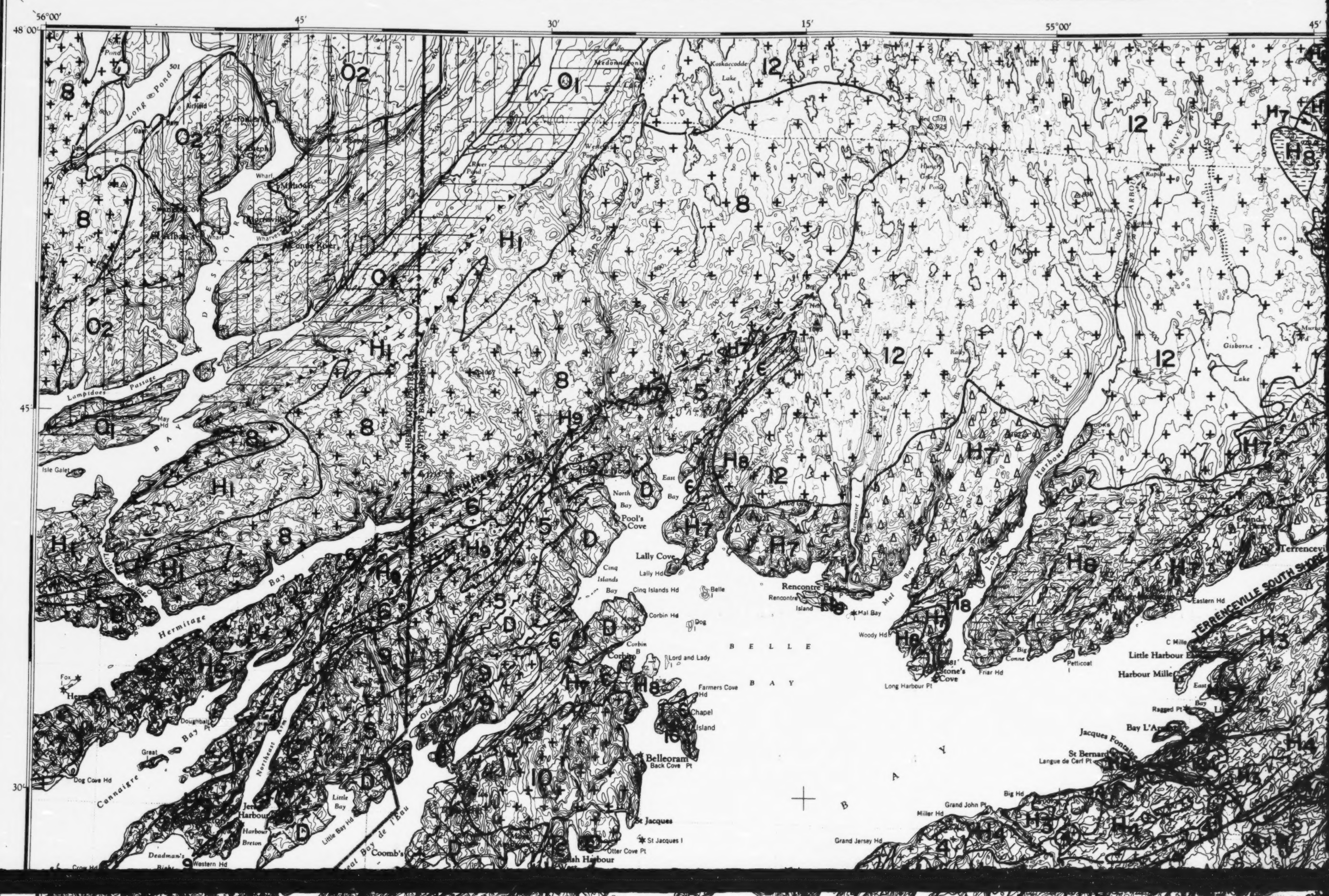
DEPARTMENT OF ENVIRONMENT
GOVERNMENT OF NEWFOUNDLAND AND LABRADOR

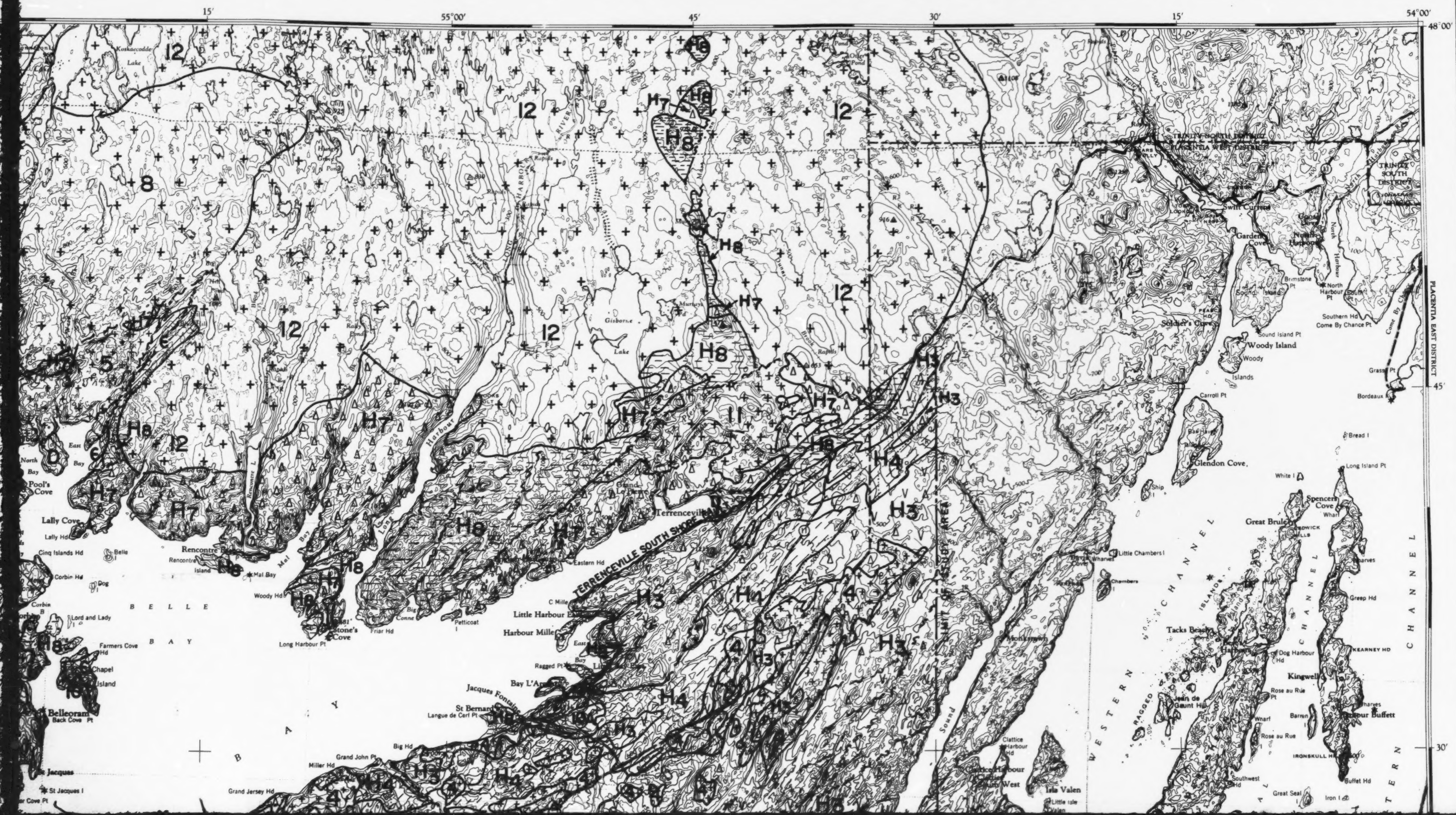
MAP No. 1

**SURFICIAL GEOLOGY AND
HYDROSTRATIGRAPHIC UNITS**
BURIN PENINSULA AREA, NEWFOUNDLAND
Golder Associates

SCALE 1:250,000 ÉCHELLE

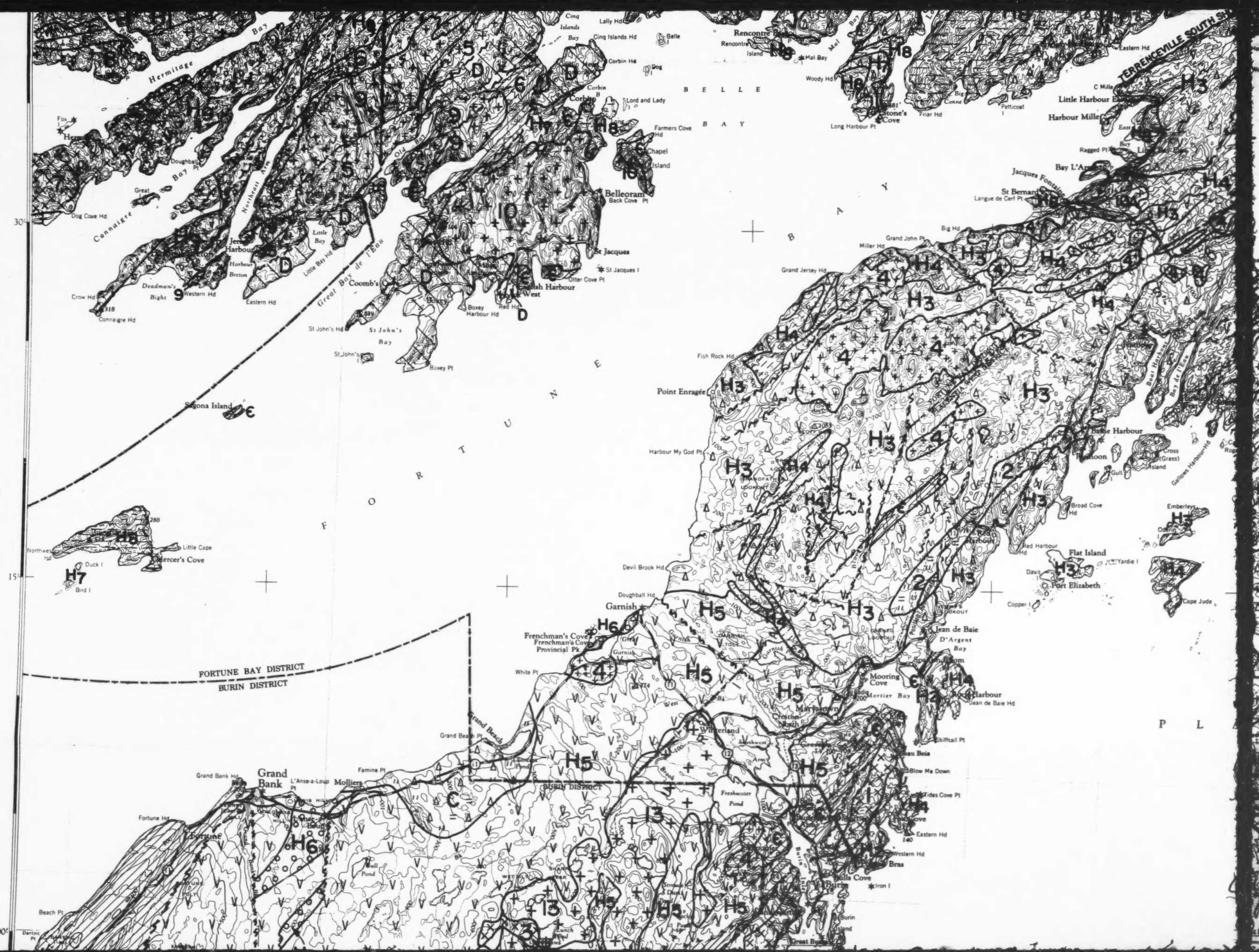


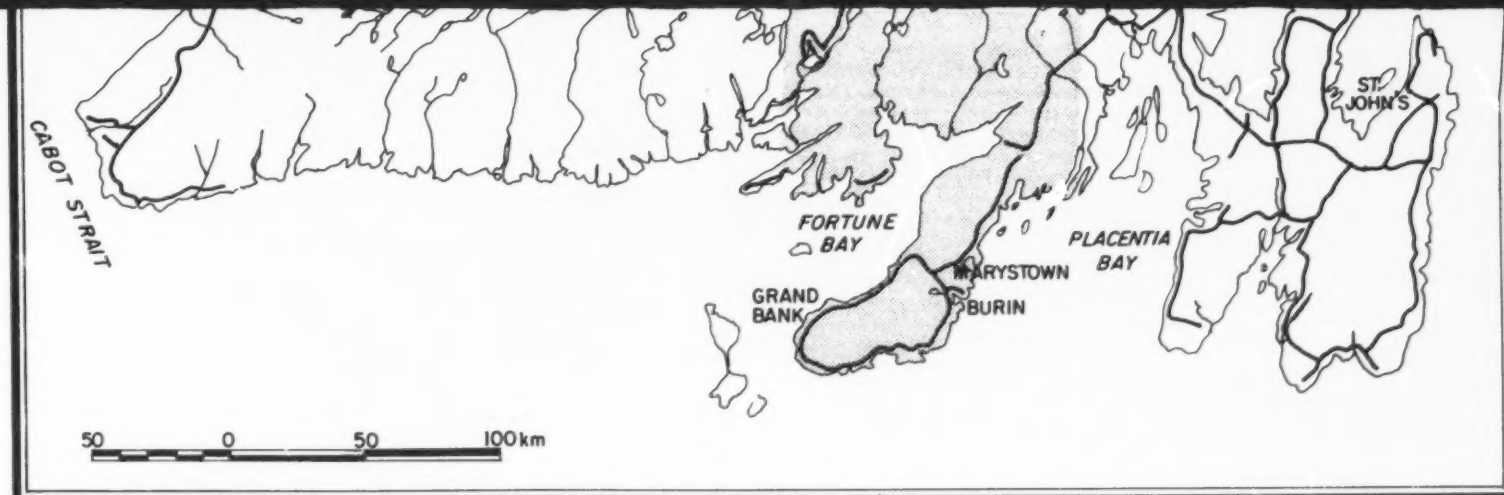
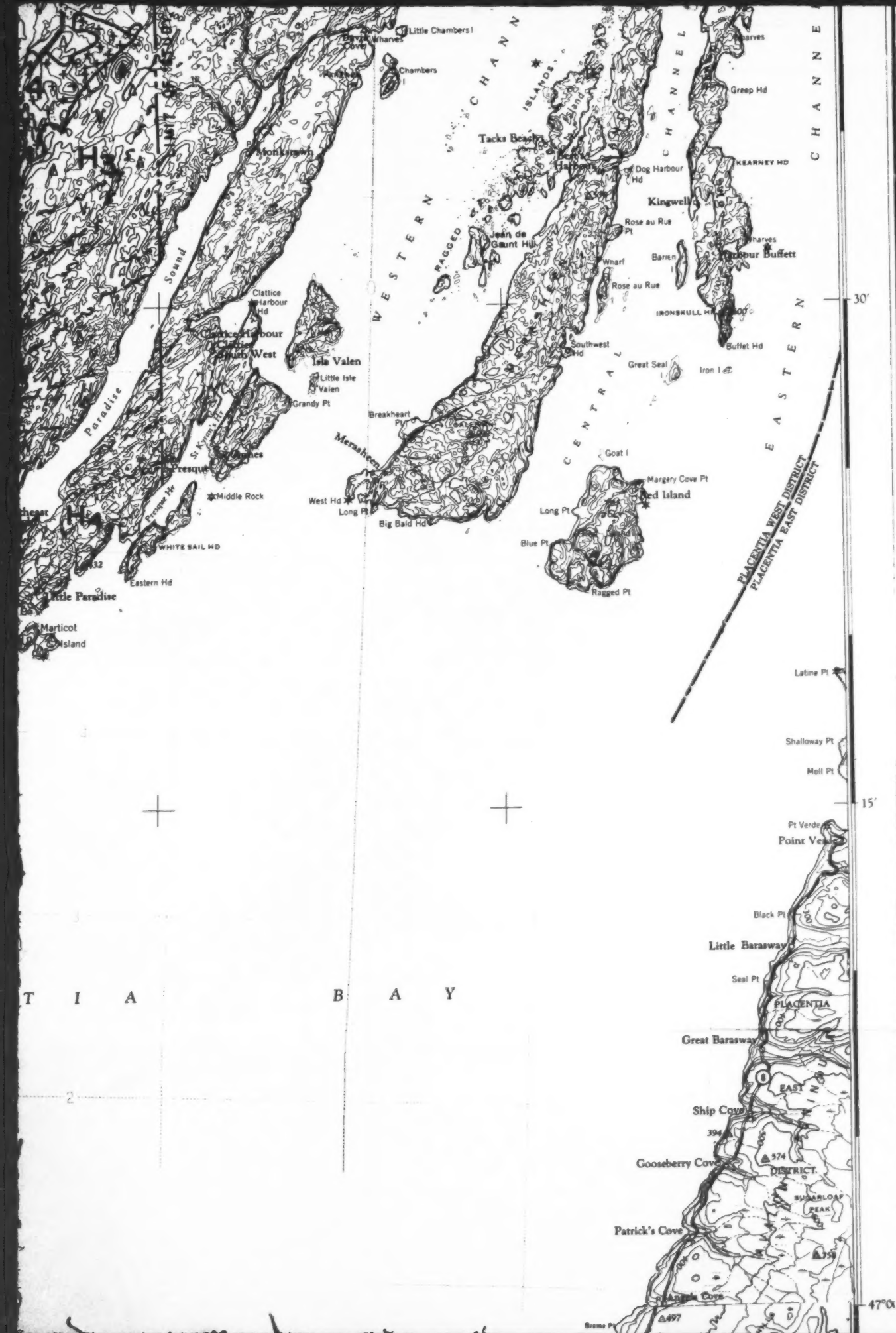




PLACENTIA EAST DISTRICT

CABOT STRAIT





CARBONIFEROUS

GRAND BEACH COMPLEX

C FELSIC VOLCANICS, INCLUDING RHYOLITE PYROCLASTICS, PORPHYRY, MINOR MAFIC VOLCANICS

DEVONIAN

D GREAT BAY DE L'EAU, PODS COVE AND CINU ISLES FORMATIONS - RED TO PURPLE CONGLOMERATE, ARKOSIC TO MICACEOUS SANDSTONE, MINOR RED SHALE AND LIMESTONE

SILURIAN - DEVONIAN

ORDOVICIAN

BAIE D'ESPOIR GROUP

O2 PELITE, SILTSTONE, GRAPHITIC SLATE, SANDSTONE

O1 SEMI-PELITIC SCHIST AND PHYLLITE, PSAMMITE, METACONGLOMERATE, GRAPHITIC SCHIST

CAMBRIAN

E SHALE, SILTSTONE, MUDSTONE, SANDSTONE, MINOR LIMESTONE

HADRYNIAN

CONNAIGRE BAY GROUP

H9 RED AND PURPLE CONGLOMERATE, GREY AND GREEN SHALE, MAFIC VOLCANICS, TUFF, MINOR FELSIC VOLCANICS

LONG HARBOUR GROUP

H8 PURPLE SANDSTONE, CONGLOMERATE, GREY ARGILLITE, SILTSTONE

H7 FELSIC VOLCANICS, TUFF AND AGGLOMERATE, MINOR BASALT, ANDESITE, SEDIMENT AND SCHIST

MARYSTOWN GROUP

H6 RED CONGLOMERATE, SANDSTONE, SILTSTONE, SHALE, MINOR VOLCANICS

H5 MAFIC TO FELSIC VOLCANICS INCLUDING FLOWS, PYROCLASTICS, BOTH SUBAERIAL AND WATERLAIN, MINOR CHLORITE AND SERICITE SCHISTS

LOVE COVE GROUP

H4 GREY AND GREEN VOLCANOGENIC SANDSTONE, CONGLOMERATE, CROSS-BEDDED LITHIC SANDSTONE, THICKLY BEDDED GREY AND GREEN ARGILLITE

H3 FELSIC VOLCANIC FLOWS AND PYROCLASTICS, MAFIC FLOWS, SERICITE AND CHLORITE S 1157S

BURIN GROUP

H2 MAFIC VOLCANICS, MINOR GREY AND GREEN SILTSTONE, SANDSTONE, CONGLOMERATE, SHALE, DOLOMITE

LITTLE PASSAGE GNEISSES

H1 SEMI-PELITIC AND PSAMMITIC PARAGNEISS WITH MINOR UNSEPARATED GRANITIC AND AMPHIBOLITIC GNEISS

LEGEND

ST. LAWRENCE GRANITE

13 ALKALINE TO PERALKALINE ALASKITE GRANITE INCLUDES ROCKY RIDGE COMPLEX PORPHYRYTIC RHYOLITE

ACKLEY GRANITE

12 FINE TO COARSE GRAINED, MASSIVE, EQUIGRANULAR, X-SPAR PORPHYRYTIC, BIOTITE GRANITE

CROSS HILLS INTRUSIVE SUITE

11 MEDIUM GRAINED, HORNBLende-BIOTITE GRANODIORITE, FINE GRAINED GRANITE, DIABASE, GABBRO, DIORITE, ALASKITE

BELLEORAM GRANITE

10 MEDIUM TO COARSE GRAINED, GREY TO PINK GRANITE; 10A BERRY HILLS PLUTON, MEDIUM GRAINED ADAMELITE

HARBOUR BRETON GRANITE

9 MEDIUM TO COARSE GRAINED, PINK ALASKITIC GRANITE, PORPHYRYTIC BIOTITE GRANITE

NORTH BAY GRANITE, DOLLARD LIGHT GRANITE, NORTHWEST BROOK COMPLEX, GAULTOIS GT.

8 EQUIGRANULAR TO PORPHYRYTIC, LOCALLY GARNETIFEROUS, MUSCOVITE OR BIOTITE GRANITE AND BIOTITE HORNBLende-GRANODIORITE

GROLE DIORITE

7 DARK GREY DIORITE, QUARTZ DIORITE, MEDIUM TO COARSE GRAINED BLACK, HORNBLende-PYROXENE GABBRO

STRADDLING GRANITE

6 MEDIUM GRAINED, PINK TO ORANGE, ALASKITE GRANITE, PINK HORNBLende-BIOTITE BUFF TO GREY GRANODIORITE, FELSITE

SIMMONS BROOK BATHOLITH

5 MEDIUM GRAINED, EQUIGRANULAR HORNBLende-BIOTITE GRANODIORITE

CAPE ROGER MOUNTAIN BATHOLITH, SEAL COVE PLUTON, ANCHOR DROGUE GRANODIORITE

4 FINE TO MEDIUM GRAINED, FOLIATED HORNBLende-BIOTITE GRANODIORITE, WITH SUBORDINATE GABBRO, APLITE AND DIABASE AND DIORITE, UNNAMED HADRYNIAN GRANITOID: FINE TO MEDIUM GRAINED, EQUIGRANULAR, FOLIATED, HORNBLende-BIOTITE GRANITE AND GRANODIORITE, MINOR APLITE AND PORPHYRYTIC PHASES

LAUGHLINS HILL GABBRO

3 COARSE GRAINED HORNBLende-GABBRO

RHYOLITE PORPHYRY

2 RHYOLITE PORPHYRY

WANDSWORTH INTRUSIVES

1 COARSE TO FINE GRAINED, LOCALLY LAYERED GABBRO, GRANODIORITE, QUARTZ DIORITE

SYMBOLS

GEOLOGICAL BOUNDARY

FAULT

SOURCE OF INFORMATION
GEOLOGICAL COMPILATION, MAPS, IM BELLEORAM AND, IL, ST. LAWRENCE BY



T I A B A Y

BASE MAP COMPILED FROM PORTIONS OF NATIONAL TOPOGRAPHIC SURVEY MAPS 1L AND 1M.

CONTOUR INTERVAL 100 FEET
Elevations in Feet above Mean Sea Level
North American Datum 1927
Transverse Mercator Projection



SILURIAN - DEVONIAN

ORDOVICIAN

BAIE D'ESPOIR GROUP

O2 PELITE, SILTSTONE, GRAPHITIC SLATE, SANDSTONE

O1 SEMI-PELITIC SCHIST AND PHYLLITE, PSAMMITE, METACONGLOMERATE, GRAPHITIC SCHIST

CAMBRIAN

E SHALE, SILTSTONE, MUDSTONE, SANDSTONE, MINOR LIMESTONE

HADRYNIAN

CONNAIGRE BAY GROUP

H9 RED AND PURPLE CONGLOMERATE, GREY AND GREEN SHALE, MAFIC VOLCANICS, TUFF, MINOR FELSIC VOLCANICS

LONG HARBOUR GROUP

H8 PURPLE SANDSTONE, CONGLOMERATE, GREY ARGILLITE, SILTSTONE

H7 FELSIC VOLCANICS, TUFF AND AGGLOMERATE, MINOR BASALT, ANDESITE, SEDIMENT AND SCHIST

MARYSTOWN GROUP

H6 RED CONGLOMERATE, SANDSTONE, SILTSTONE, SHALE, MINOR VOLCANICS

H5 MAFIC TO FELSIC VOLCANICS INCLUDING FLOWS, PYROCLASTICS, BOTH SUBAERIAL AND WATERLAIN, MINOR CHLORITE AND SERICITE SCHISTS

LOVE COVE GROUP

H4 GREY AND GREEN VOLCANOGENIC SANDSTONE, CONGLOMERATE, CROSS-BEDDED LITHIC SANDSTONE, THICKLY BEDDED GREY AND GREEN ARGILLITE

H3 FELSIC VOLCANIC FLOWS AND PYROCLASTICS, MAFIC FLOWS, SERICITE AND CHLORITE SCHISTS

BURIN GROUP

H2 MAFIC VOLCANICS, MINOR GREY AND GREEN SILTSTONE, SANDSTONE, CONGLOMERATE, SHALE, DOLOMITE

LITTLE PASSAGE GNEISSES

H1 SEMI-PELITIC AND PSAMMITIC PARAGNEISS WITH MINOR UNSEPARATED GRANITIC AND AMPHIBOLITIC GNEISS

SOURCE OF INFORMATION
GEOLOGICAL COMPILATION, MAPS, 1M, BELLEoram AND, 1L, ST. LAWRENCE BY
S.J. O'BRIEN, C.F. O'DRISCOLL AND S.P. COLMAN-SADD WITH CONTRIBUTIONS BY
W.L. DICKSON, T.P. FLETCHER, B.A. GREENE, D.F. STRONG AND H. WILLIAMS.

NORTH BAY GRANITE, DOLLARD LIGHT GRANITE, NORTHWEST BROOK COMPLEX, GAULTOIS GT.

8 EQUIGRANULAR TO PORPHYRITIC, LOCALLY GARNETIFEROUS, MUSCOVITE OR BIOTITE GRANITE AND BIOTITE HORNBLENDE-GRANODIORITE

GROLE DIORITE

7 DARK GREY DIORITE, QUARTZ DIORITE, MEDIUM TO COARSE GRAINED BLACK, HORNBLENDE-PYROXENE GABBRO

STRADDLING GRANITE

6 MEDIUM GRAINED, PINK TO ORANGE, ALASKITE GRANITE, PINK HORNBLENDE-BIOTITE BUFF TO GREY GRANODIORITE, FELSITE

SIMMONS BROOK BATHOLITH

5 MEDIUM GRAINED, EQUIGRANULAR HORNBLENDE-BIOTITE GRANODIORITE

CAPE ROGER MOUNTAIN BATHOLITH, SEAL COVE PLUTON, ANCHOR DROGUE GRANODIORITE

4 FINE TO MEDIUM GRAINED, FOLIATED HORNBLENDE-BIOTITE GRANODIORITE, WITH SUBORDINATE GABBRO, APLITE AND DIABASE AND DIORITE; UNNAMED HADRYNIAN GRANITOID: FINE TO MEDIUM GRAINED, EQUIGRANULAR, FOLIATED, HORNBLENDE-BIOTITE GRANITE AND GRANODIORITE, MINOR APLITE AND PORPHYRITIC PHASES

LAUGHLINS HILL GABBRO

3 COARSE GRAINED HORNBLENDE-GABBRO

2 RHYOLITE PORPHYRY

WANDSWORTH INTROSIVES

1 COARSE TO FINE GRAINED, LOCALLY LAYERED GABBRO, GRANODIORITE, QUARTZ DIORITE

SYMBOLS

GEOLOGICAL BOUNDARY

FAULT

THRUST FAULT



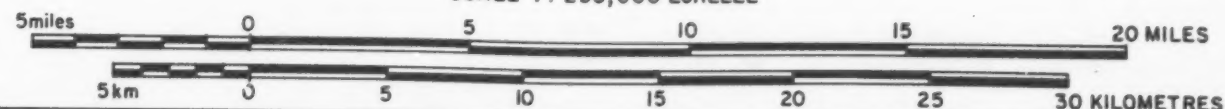
DEPARTMENT OF ENVIRONMENT
GOVERNMENT OF NEWFOUNDLAND AND LABRADOR

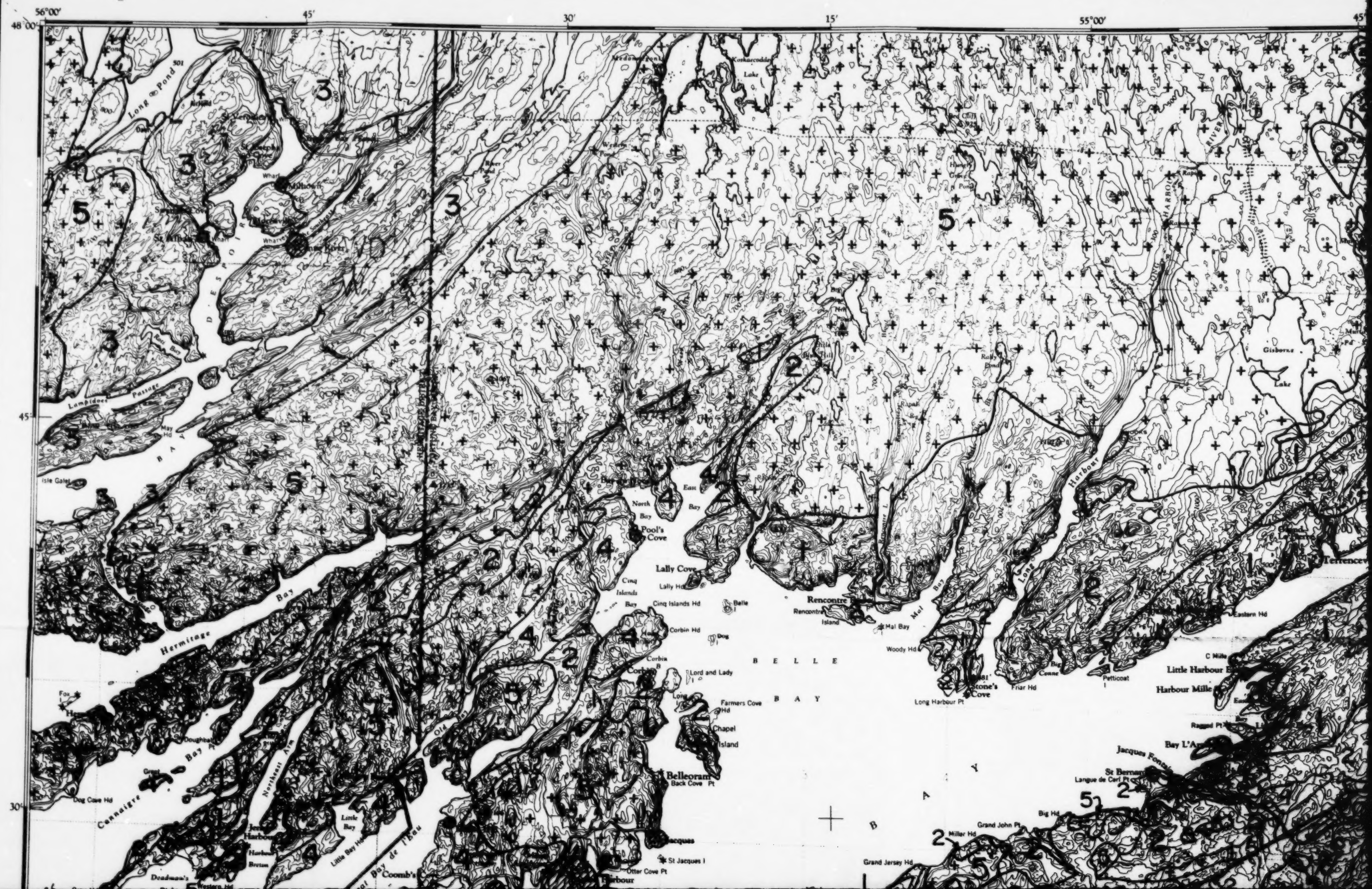
MAP No. 2

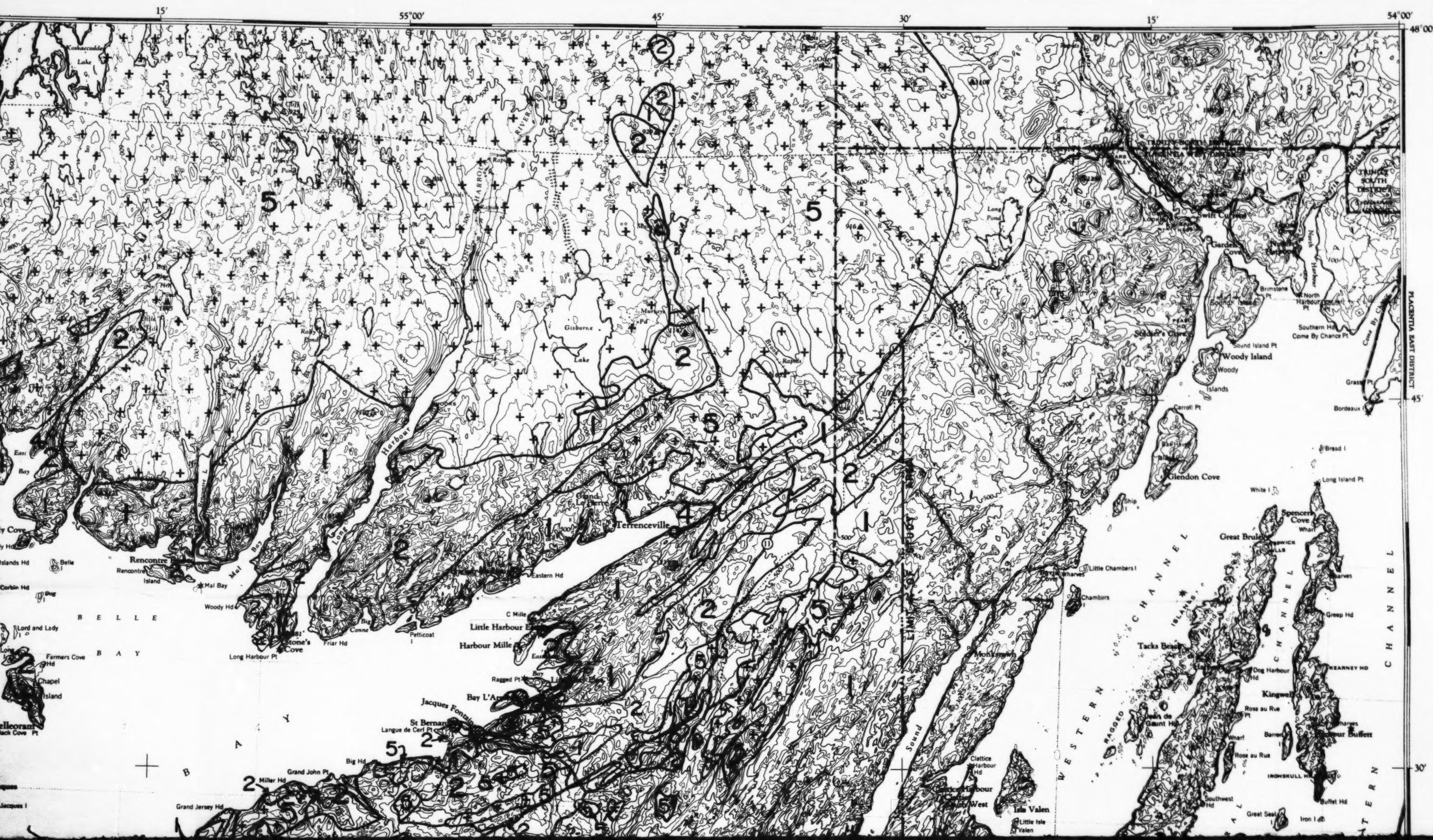
BEDROCK GEOLOGY BURIN PENINSULA AREA, NEWFOUNDLAND

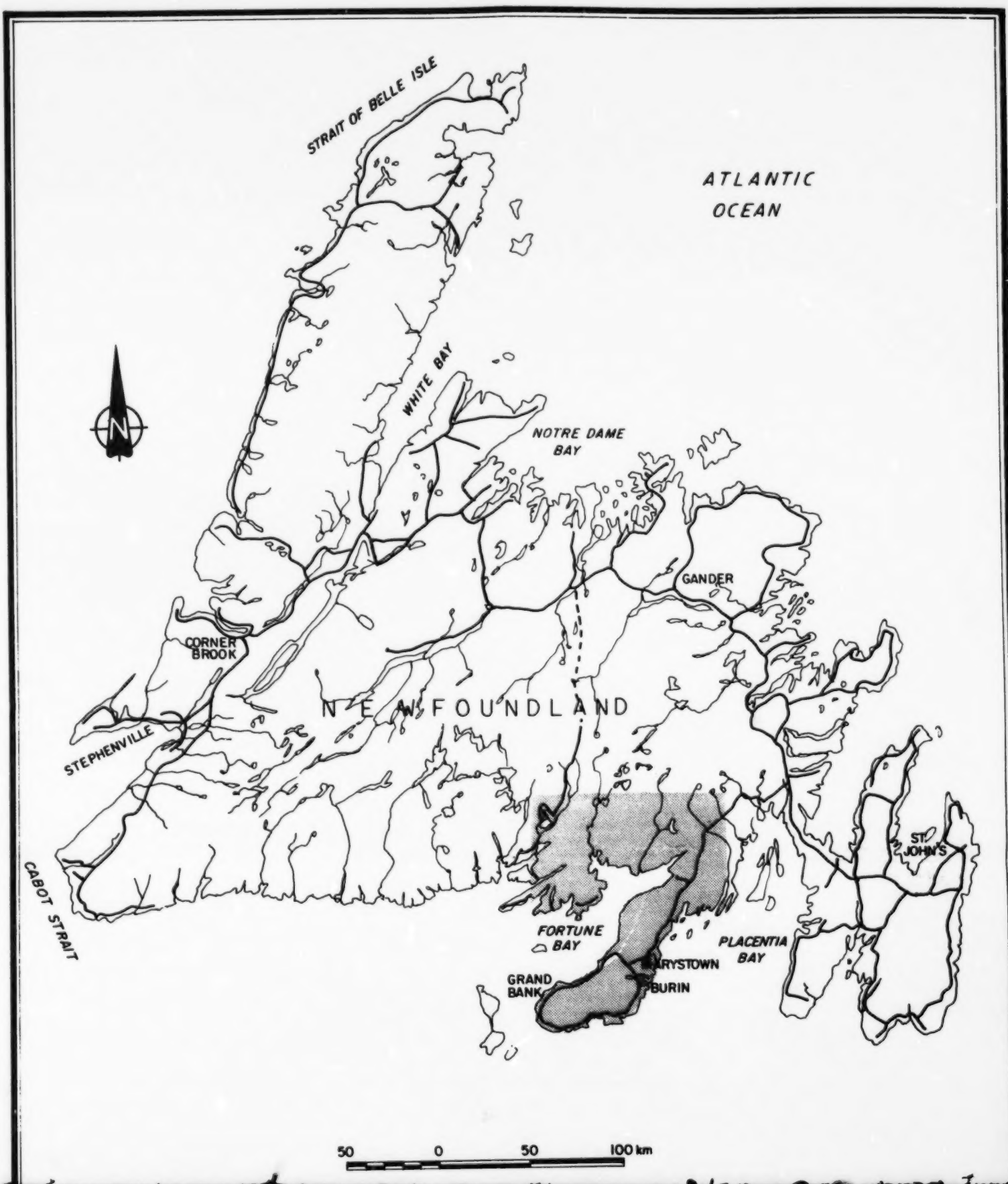
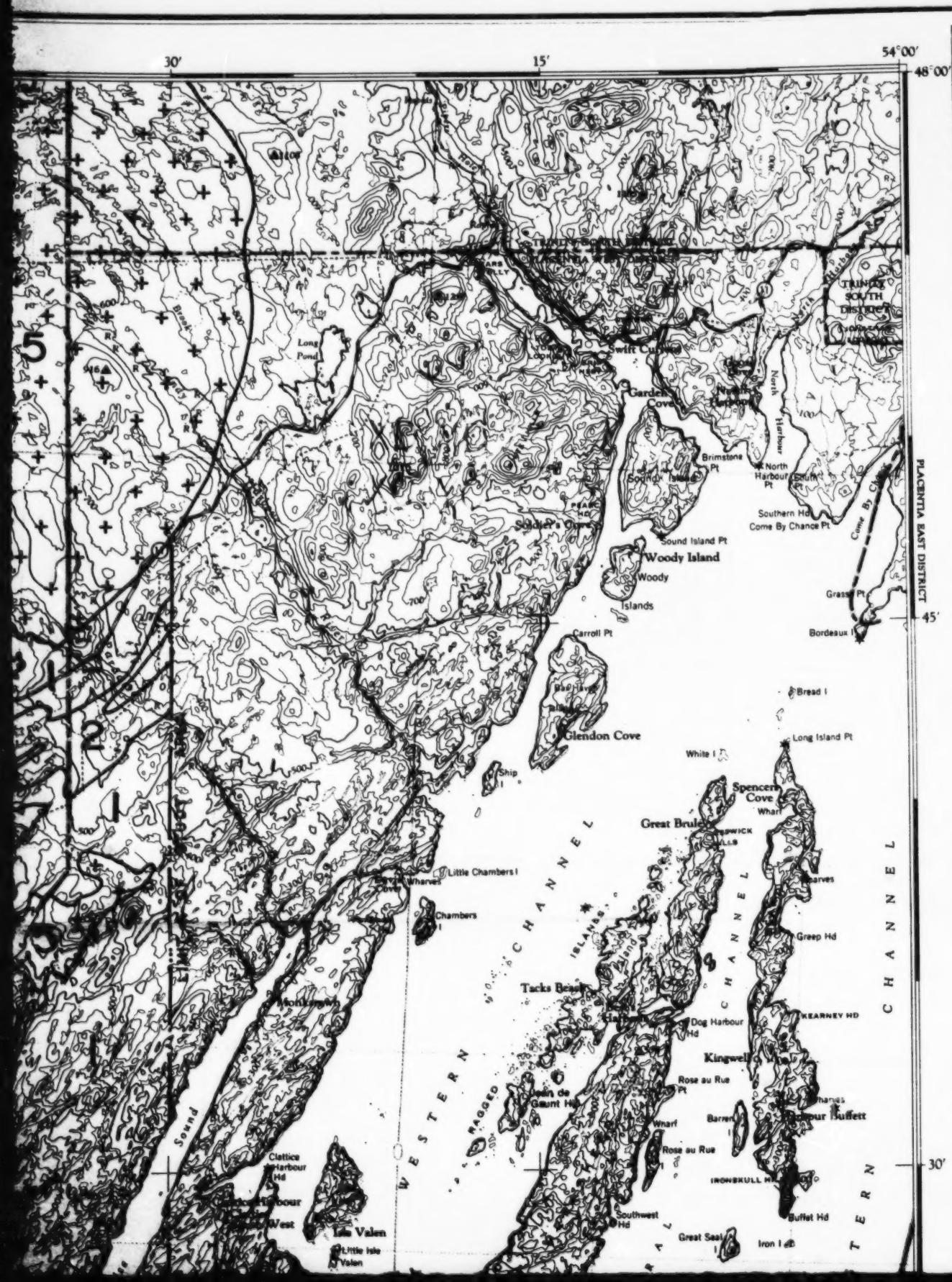
Golder Associates

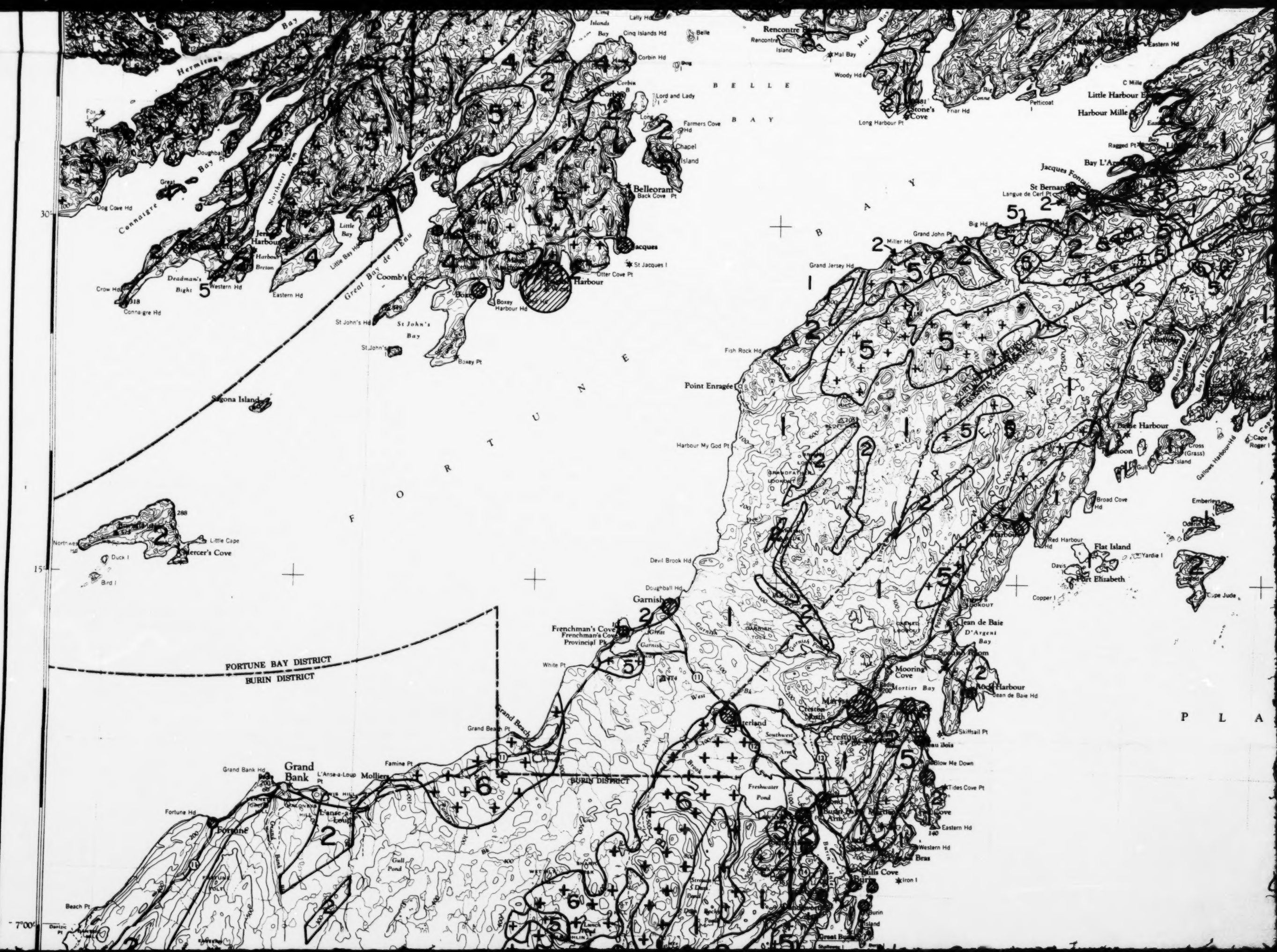
SCALE 1 : 250,000 ÉCHELLE

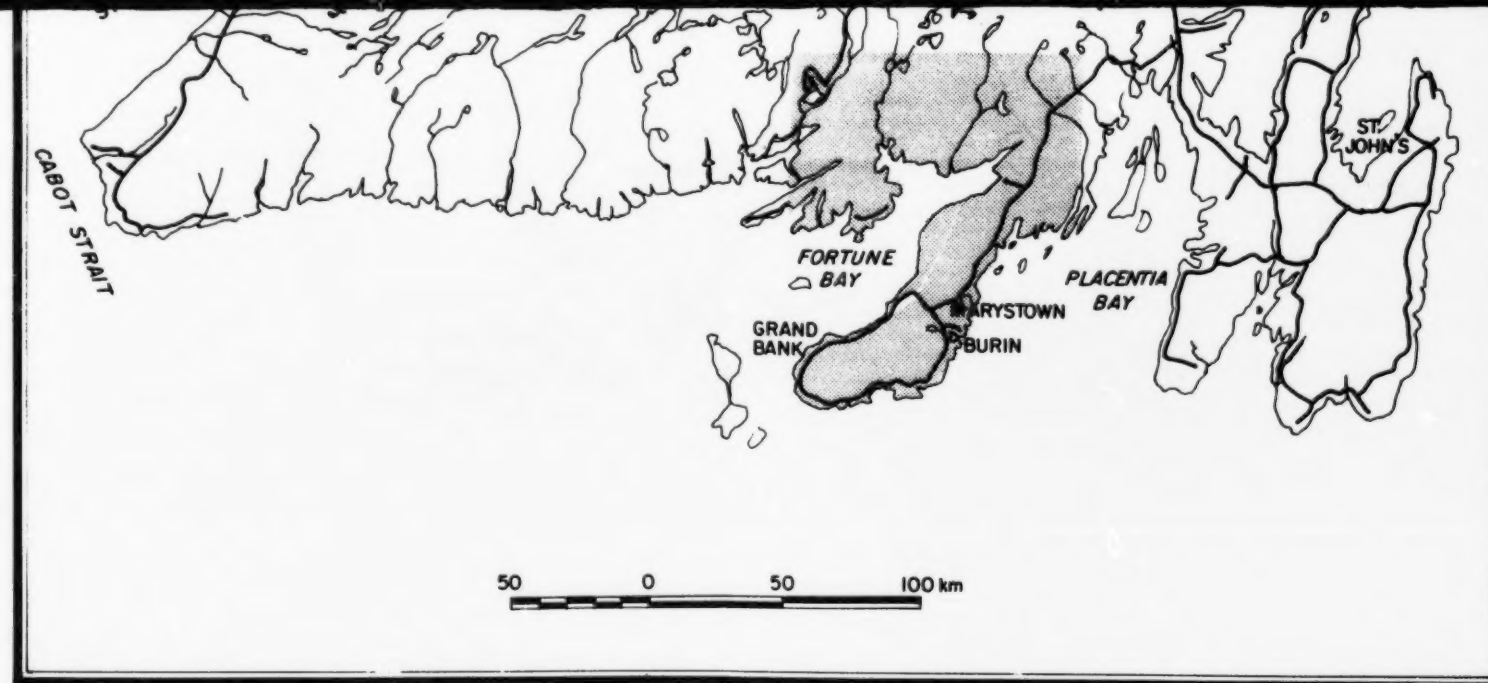








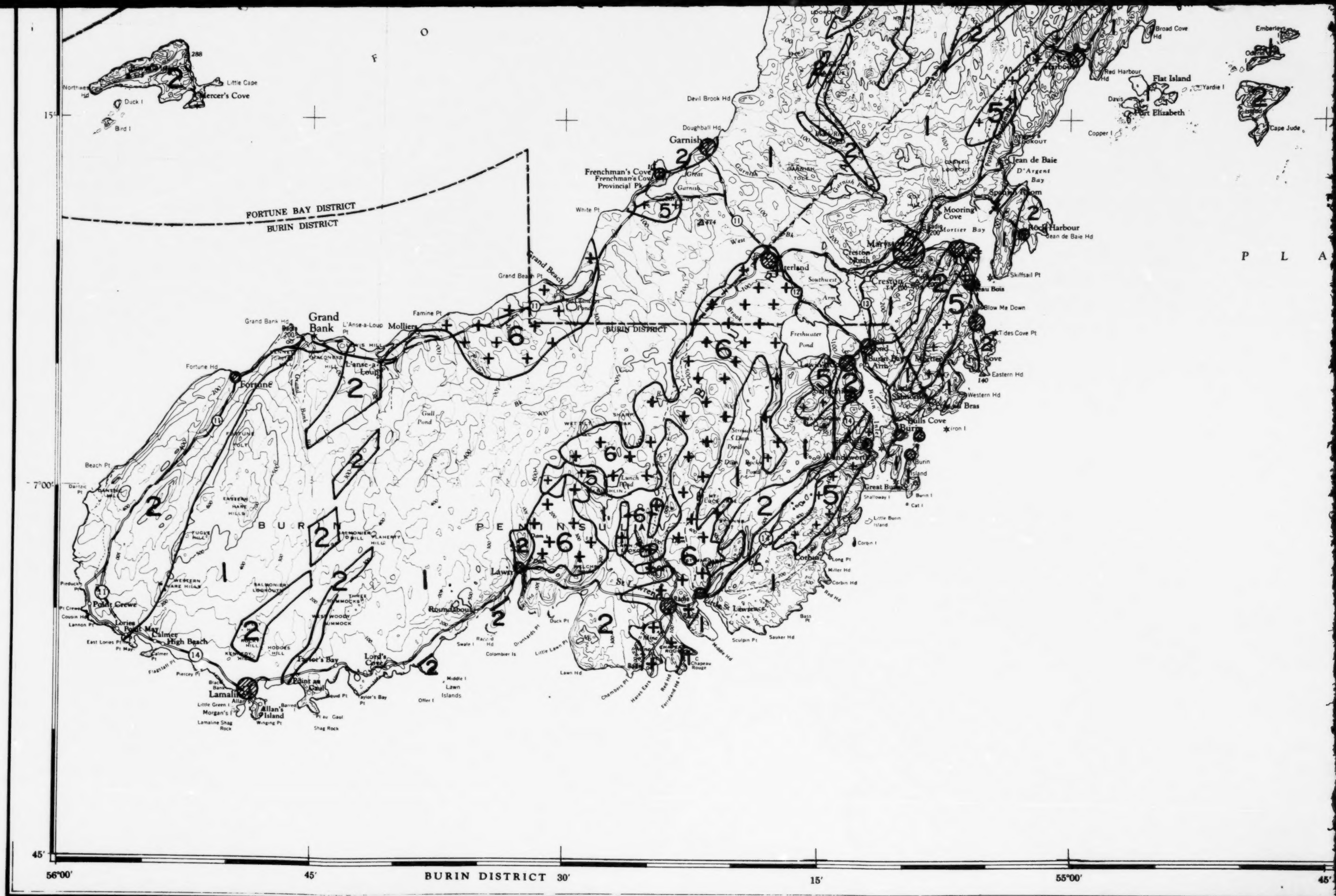




BEDROCK HYDROSTRATIGRAPHIC UNITS						
BEDROCK HYDROSTRATIGRAPHIC UNIT	WELL YIELD			WELL DEPTH		
	RANGE L/min. (gpm)	MEAN L/min. (gpm)	MEDIAN L/min. (gpm)	RANGE m (ft.)	MEAN m (ft.)	MEDIAN m (ft.)
UNIT 1 HADRYNIAN VOLCANIC ROCKS	0-136.4 (0-30)	18.4 (4.2)	8.2 (1.8)	4.3-152.4 (14-500)	56.2 (184.4)	50.3 (165.0)
UNIT 2 HADRYNIAN AND CAMBRIAN SEDIMENTARY ROCKS	2.3-68.2 (0.5-15.0)	16.5 (3.6)	9.1 (2.0)	13.7-103.6 (50-340)	42.8 (140.4)	32.0 (105.0)
UNIT 3 ORDOVICIAN SEDIMEN- TARY ROCKS	0-40.9 (0-9.0)	10.5 (2.3)	4.5 (1.0)	9.1-99.1 (30-325)	57.2 (187.7)	61.0 (200.1)
UNIT 4 DEVONIAN-CARBON- IFEROUS SEDIMENTARY ROCKS	2.3-545.5 (0.5-120.0)	38.2 (8.4)	9.1 (2.0)	13.7-76.2 (50.0-250)	34.9 (114.5)	19.8 (65.0)
UNIT 5 HADRYNIAN TO DEVONIAN GRANITIC AND GNEISSIC ROCKS	2.3-136.4 (0.5-30.0)	44.9 (9.9)	20.5 (4.5)	12.2-109.7 (40-360)	43.4 (142.4)	23.4 (76.8)
UNIT 6 CARBONIFEROUS, ST. LAWRENCE GRANITE AND GRAND BEACH PORPHYRY ROCKS	2.3-136.4 (0.5-30.0)	31.6 (7.0)	13.6 (3.0)	19.8-114.3 (65-375)	48.6 (159.4)	38.1 (125.0)

NUMBER OF WELLS LISTED PER COMMUNITY;





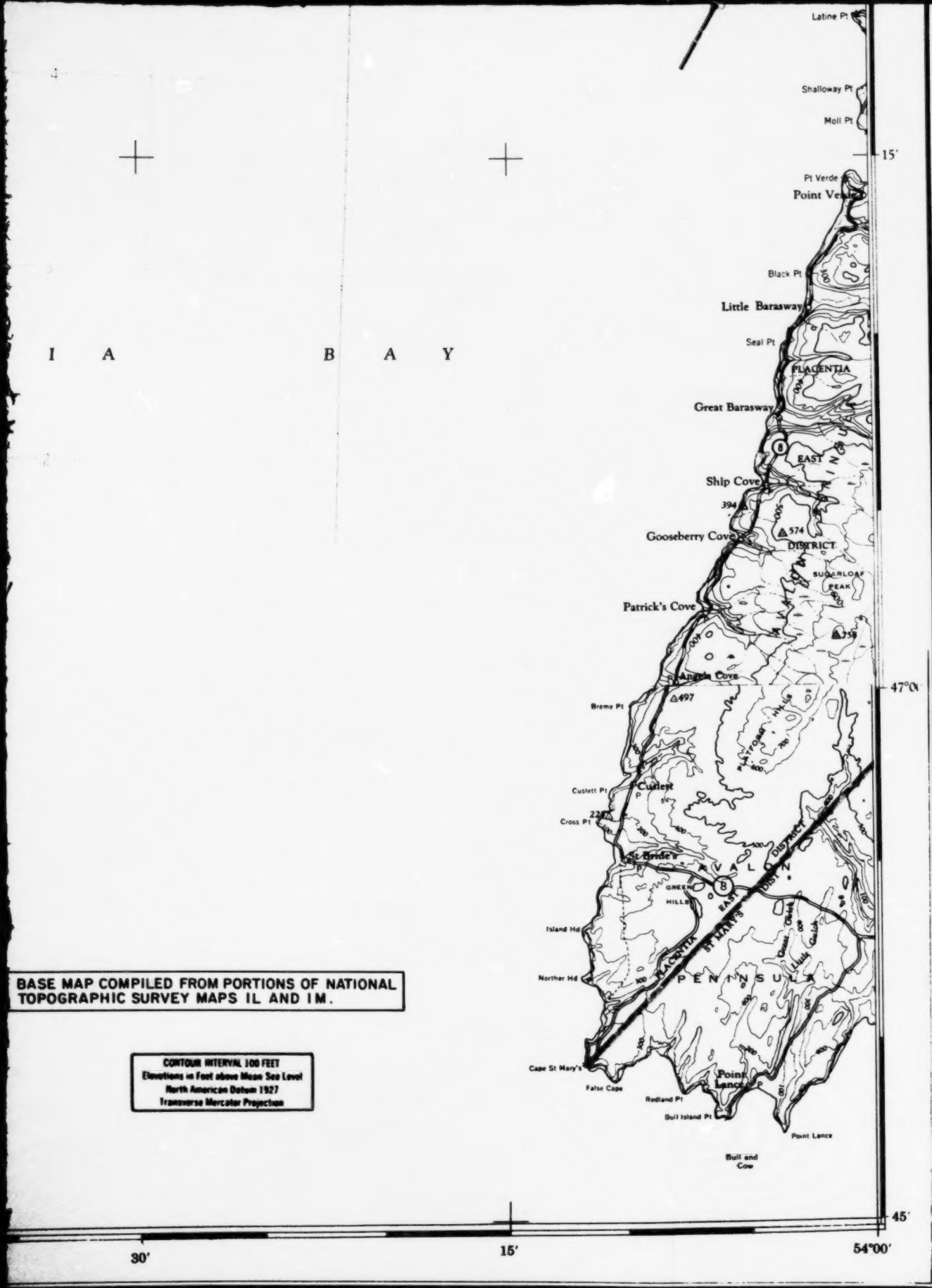


UNIT 2 HADRYNIAN AND CAMBRIAN SEDIMENTARY ROCKS	2.3-10 (0.5-1.0)
UNIT 3 ORDOVICIAN SEDIMENTARY ROCKS	0-10 (0-5)
UNIT 4 DEVONIAN-CARBONIFEROUS SEDIMENTARY ROCKS	2.3-54 (0.5-120)
UNIT 5 HADRYNIAN TO DEVONIAN GRANITIC AND GNEISSIC ROCKS	2.3-13 (0.5-30)
UNIT 6 CARBONIFEROUS, ST. LAWRENCE GRANITE AND GRAND BEACH PORPHYRY ROCKS	2.3-13 (0.5-30)

DEPARTMENT OF
GOVERNMENT

HYDROSTATIC
BURIN PENINSULA

5 miles
5 km



UNIT 2 HADRYNIAN AND CAMBRIAN SEDIMENTARY ROCKS	2.3-68.2 (0.5-15.0)	16.5 (3.6)	9.1 (2.0)	13.7-103.6 (50-340)	42.8 (140.4)	32.0 (105.0)
UNIT 3 ORDOVICIAN SEDIMEN- TARY ROCKS	0-40.9 (0-9.0)	10.5 (2.3)	4.5 (1.0)	9.1-99.1 (30-325)	57.2 (187.7)	61.0 (200.1)
UNIT 4 DEVONIAN-CARBON- IFEROUS SEDIMENTARY ROCKS	2.3-545.5 (0.5-120.0)	38.2 (8.4)	9.1 (2.0)	13.7-76.2 (50.0-250)	34.9 (114.5)	19.8 (65.0)
UNIT 5 HADRYNIAN TO DEVONIAN GRANITIC AND GNEISSIC ROCKS	2.3-136.4 (0.5-30.0)	44.9 (9.9)	20.5 (4.5)	12.2-109.7 (40-360)	43.4 (142.4)	23.4 (76.8)
UNIT 6 CARBONIFEROUS, ST. LAWRENCE GRANITE AND GRAND BEACH PORPHYRY ROCKS	2.3-136.4 (0.5-30.0)	31.6 (7.0)	13.6 (3.0)	19.8-114.3 (65-375)	48.6 (159.4)	38.1 (125.0)





DEPARTMENT OF ENVIRONMENT
GOVERNMENT OF NEWFOUNDLAND AND LABRADOR
MAP No. 3

BEDROCK HYDROSTRATIGRAPHIC UNITS

BURIN PENINSULA AREA, NEWFOUNDLAND

Golder Associates

SCALE 1: 250,000 ÉCHELLE

5miles05101520 MILES

5km051015202530 KILOMETRES